The

Electrical Review

VOL. XCVII. NOVEMBER 13, 1925. No. 2,503.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE, M.I.E.E. A.M.Inst.C.E. *Commercial Editor:* A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address. "AGEEKAY, CENT., LONDON." Code, A B C. Telephone No.: Central 7072 (Three Lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

LIST OF FOREIGN AGENTS (see first page "Official Notices").

Contents:

	PAGE
Electricity Supply in the London District	761
A Slight upon the Technical Press	762
Next Year's Wireless Exhibition	762
The Progress of E.D.A.	762
The North Wales Accident	762
Notes from New Zealand	763
Electricity Supply in Great Britain—V (*illus.*)	764
Modern Electric Cookers (*illus.*)	766
Three-phase Transmission Lines, by Graham Ashworth (*illus.*)	767
The Commercial Motor Exhibition (*concluded*)	770
Refractory Formers for Electric Fires, by C. H. S. Tupholme	771
The North Wales Dam Accident, by Theodore Stevens (*illus.*)	772
Dielectric Problems in High-voltage Cables, by P. Dunsheath (*illus.*)	774
Business Notes	775
Lighting and Power Notes	779
Tramway and Railway Notes	780
Telegraph and Telephone Notes	781
Radio Notes	781
Contracts Open and Closed	781
Forthcoming Events	782
Notes	782
Institution Notes	784
Our Personal Column	784
New Companies Registered	785
Official Returns of Electrical Companies	786
City Notes	786
Stocks and Shares	787
Market Quotations for Chemicals and Metals	788
United States Electrical Exports	789
Selected Radio-telephone Apparatus (*illus.*)	791
The Electrical Trades Benevolent Institution	792
The Salesman's Art	792
The Distribution of Electricity	793
London and Home Counties Electricity District	793
Correspondence—	
Rural Electricity Supply	794
Motor Converters *v.* Rotary Converters	795
Two-way Pendant Switch Flexibles	796
The Cost of House Wiring	796
The Metering of Three-phase Power	796
Broadcasting Power	796
Is the Contracting Business Degenerating?	796
Do Small Manufacturers Lack Ambition?	797
Firemen's Risks	797
Legal	797
Reviews	799
Trade-mark Applications	800
Published Specifications	800
Contractors' Column	Advertisement page xxxiv

Electricity Supply in the London District.

THE inauguration of the new Joint Electricity Authority for the London and Home Counties Electricity District on Wednesday last week was, in the words of Sir John Snell, "an historic occasion," to which the newly elected chairman, Mr. Duncan Watson, referred as "the dawn of a new era that . . . will confer incalculable benefit upon the 8¼ millions of people in Greater London." We sincerely hope that these words will be justified by the event. London for a generation has awaited the reforming hand which shall bring order out of chaos and resolve the welter of discordant systems into one grand harmony; to Mr. Watson has fallen the lot of leader for the first three years of the campaign, and we heartily congratulate him on the honour conferred upon him by his 32 colleagues. We trust that under his guidance the Joint Authority will receive its initial impetus in the right direction, and that his successors will keep the ball rolling till the goal is won.

He will not, however, find the game all play and no work—nor would he wish it so, accustomed as he is to delight in a tough set-to; he is the captain of an ill-assorted team, the members of which have yet to learn to play for the side and not for their own ends. The problem of London's electricity supply bristles with vested interests, both company and municipal, to an even greater extent than that of any other area in this country, where possession seems to comprise 99 points of the law. The companies have made a good bargain with the London County Council; the municipal authorities have not yielded an inch, and there is—as yet—no power to compel them to do so, save the control over extensions wielded by the Electricity Commissioners, which has been exercised so far with remarkable restraint, except in the case of minor undertakings. *The parochial spirit still dominates the whole field of electricity supply.* This is none the less true because we see many undertakings reaching out to supply larger and larger areas, adding unto themselves acre after acre—that is good practice inasmuch as it makes for economy, but it is by a development and expansion of the same spirit that it is prompted.

Heartily therefore do we welcome Mr. Duncan Watson's declaration from the chair of the London Authority: "Hitherto, largely owing to our ultra-parochial and insular policy, electricity supply has developed into a complicated and chaotic condition which has no parallel. There has also existed a clashing and conflict of interests not merely between one section and another, but actually within representative sections, resulting in much misunderstanding, and not a little prejudice. From to-day this must go. Every barrier must be swept aside."

These are brave words; but they show the right spirit. It rests with Mr. Duncan Watson to convince his colleagues of their truth and wisdom. He will have a hard task, as he well knows; he will need all the courage and firmness with which he is credited, and he has our best wishes for his success in a great undertaking.

A Slight upon the Technical Press.

THE inauguration of the most important Joint Electricity Authority in the country—the only such Authority that is in full operation at present, for the North Wales and South Cheshire J.E.A. has delegated its supply powers to the North Wales Power Company—might reasonably be regarded as a ceremony at which the electrical Press would be represented. The event is certainly of interest to its many thousands of readers, at home and abroad, not only in respect of its particular bearing upon the future welfare of one-fifth of the population of this country, but also in its more general aspect as one of the most important achievements of the Electricity Commissioners.

Nevertheless, whilst the lay Press was represented at the inaugural meeting of the London Authority, the technical Press was neither invited to send representatives nor even informed that the meeting was to take place.

Next Year's Wireless Exhibition.

WE have received several further communications respecting the subject of too many wireless exhibitions since we expressed the opinion (ELECTRICAL REVIEW, October 23rd, p. 643) in favour of the holding in 1926 of only one exhibition, and that open to all British manufacturers. Two of the communications before us support the idea of a single exhibition. Mr. J. Scott Taggart, of *The Wireless Dealer*, has received communications to the same effect from many in the trade, and some of his correspondents have given definite promises to take stands "at any exhibition we may be forced to promote to overcome a possible deadlock." He feels, as we do, that the time has come when manufacturers should realise that it is in the best interests of the industry that both N.A.R.M.A.T. and non-N.A.R.M.A.T. members should join hands in one big display, but we have no information regarding circumstances which can create a "possible deadlock" requiring him to promote an exhibition. The second communication is from a firm who announce their intention to hold an exhibition open to all during next autumn. They have been responsible for, or associated with, various wireless exhibitions at the White City, the Albert Hall, and at Manchester, and they invite all sections of the British industry to support a movement which would be held on the broad lines of the Motor Show, and which would be conducted on a co-operative basis in respect of the profits accruing. Messrs. Bertram Day & Co., Ltd., from whom this letter comes, say that trade publications consider it essential that an "impartial organisation" should arrange for the exhibition, and they disclaim any partiality "to any particular body, section, or publication."

We are faced therefore at the moment with the threat of two exhibitions next year, each promoted by a party which is convinced that what the industry needs is one big show! It may seem to be early to talk about what will happen in the autumn of 1926, but it is not too soon for firms who are interested in the trade to express themselves emphatically against duplication. We hold no brief for either party. We hope that the industry itself will find it possible to decide between the two Richmonds who are in the field. If it does not do so promptly we may have two and perhaps more wireless exhibitions in London next year.

The Progress of E.D.A.

As the result of the special efforts that have been made since the last annual meeting of the British Electrical Development Association, the permanent annual income from electricity supply members has been considerably increased. Between fifty and sixty new members from this department of the industry have been enrolled, and the new income thus secured, together with the additional contributions from authorities already subscribing, has more than trebled the supply quota of the total revenue of the organisation. There is, of course, still room for substantial improvement so that the movement may become that big affair that the future of electricity requires and fully justifies. The sum now guaranteed, however, is sufficient to enable the Council and its director, Mr. Beauchamp, and staff, to push on with their larger operations. It of necessity follows that the handling of a larger volume of material and the general increase of work have involved some adjustment of, and additions to, the *personnel*. It will be agreed that the strengthening of the staff by the appointment of an official to take charge of the accountancy side of operations was a desirable proceeding. That has been seen to, and the preparation of Press and advertising matter has been placed under the supervision of Mr. Lovelace, whose experience in advertising publicity will doubtless form a valuable accession, especially as a National Electrical Advertising Campaign is to be one of the more prominent activities of the Association during the coming months. Mr. V. W. Dale will continue to act as Business Manager, but the changes will release him for more direct action in co-operation with his Chief. Very shortly the Press campaign of the winter months will be in full swing, a large number of newspapers and periodicals being chosen as the vehicles for conveying to the public mind the appropriate story of what electricity can and cannot do.

The North Wales Accident.

THE whole country has read with the deepest regret the story of the breakdown of a storage dam belonging to the North Wales Power Company, and its disastrous consequences, of which by far the most deplorable was the loss of 16 lives, including women and children, under terrifying conditions. It was indeed forutnate that the village of Dolgarrog was not in the direct line of the raging torrent of three million tons of water which rushed down the hillside—otherwise the death-roll would have been very heavy.

Nature's gifts of energy are not to be harvested like crops from the fields without the exaction of a toll of life and limb; our coal mines from time to time have been the scenes of catastrophes, none the less terrible because of their familiarity, but we have hundreds of mines and very few large water-powers, so that the spectacular failure of a dam exercises the imagination even more vividly than an explosion in a coal mine.

From the material point of view, the damage fortunately appears to be less serious than the earlier reports implied, and the fact that one generator at Dolgarrog was running a few days after the accident indicates that the power station was not badly injured. Mr. Theodore Stevens, M.Inst.C.E., who has visited the spot, communicates his observations on another page of this issue, and from these it seems possible that the lower dam will be made good within a few weeks. The condition of the Eigiau dam will doubtless call for serious consideration, for though the dam itself is intact, it will be useless until the soundness of the foundation is ensured. In the meantime the supply of electricity to the many towns concerned has been restored by various expedients.

Notes from New Zealand.

(From Our Own Correspondent.)

Storage Battery Tramcars.

GISBORNE, N.Z., the leading city on the east coast of the North Island, decided in 1913 to go in for a system of storage battery tramcars; the experiment was watched with interest by other cities and towns, but the undertaking was run at a loss for a number of years. The cause of the loss was not suspected until Messrs. Vickerman & Lancaster, engineers, of Wellington, made an examination on behalf of the municipality, and their report just received should prove of great assistance to the Gisborne people in placing their tramway system on a thoroughly sound business footing.

At present the tramway system in Gisborne consists of only a few miles of track laid on the main thoroughfares, and it just fails to accommodate the potential passenger traffic located in three of the most populous portions of the city and its suburbs. The engineers recommend that extensions be added to the present track system to overcome this drawback, and also a general speeding up of the existing service. It is considered that the adoption of these proposals will put the tramway system on a very strong footing.

The interesting point in connection with Gisborne's tramcars is that they are the only storage battery cars operating in any part of the world under the authority of a municipality. The engineers have now recommended their retention, being of the opinion that they are cheaper than either the standard or the railless trolley type, and practically as cheap as either the petrol or the battery 'bus. It will be interesting to watch the new developments with the storage battery tramcars under the more favourable conditions.

Electric Milking Plants.

The chief engineer of the Franklin Power Board, N.Z., recently presented in a report to the Board the following scale of charges for milking installations:—100 cows, 2-h.p. motor, 6-cow plant: £27 to £30 per annum. 75 cows, 2-h.p. motor, 4-cow plant: £24 to £26 per annum. 50 cows, 2-h.p. motor, 4-cow plant: £21 to £24 per annum. 30 cows, 1½-h.p. motor, 3-cow plant: £14 to £17 per annum. 20 cows, 1-h.p. motor, 2-cow plant: £12 to £14 per annum.

The prices include water pumping and separating, but the actual cost in each shed was fixed according to the time taken to milk and the type and running condition of the plant.

Milking by electricity is becoming quite a feature of the New Zealand dairying industry, and the progress of reticulation is bringing into this field a rapidly growing number of electrically-driven milking plants. The Central Power Board operating in Hamilton and the Waikato dairying district reported at a recent monthly meeting that an addition of 408 milking motors had been registered. A similar condition of things is also reported from other Boards, especially in those districts where sub-stations have recently been erected.

New Zealand's Hydro Minister on the Government's Hydro-electric Policy.

At the recent function in connection with the inauguration of the Orua Power Board's sub-station at Bunnythorpe, the Hon. J. G. Coates, Minister of Public Works, outlined the Government's policy in connection with hydro development. He pointed out that the narrow and nearer view was not the one most calculated to conserve the best interests of consumers. The sooner New Zealand could secure favourable prices in the world's markets, the sooner would foreign capital invest in the country, and sound hydro development made this condition of things possible by cheapening the costs of production.

The Minister stated that the taxpayers' money had been invested in hydro schemes, and he meant to see that these investments bore a rich harvest of profit for the general public. It would be the duty of the Power Boards to see that no further rates were struck after the rate for the security of the loans had been levied. The Minister was satisfied that the Government had adopted the right policy in forming the Power Board scheme, and he looked to the Boards themselves to run the hydro industry in the interests of the consumers.

Auckland's Power Plant.

Recently the Auckland Power Board held an official reception at its power station at King's Wharf for the purpose of enabling the general public to view the extent of the Board's undertakings. The function was a great success, and was attended by the Minister of Public Works and other prominent persons.

The power station consists of four 5,000-kW and one 3,000-kW sets, including the original 5,000-kW set which was installed at the inception of the station. The aggregate capacity is stated at 25,000 kW, while the present load is given at 15,000 kW. It is anticipated that the next winter peak load will reach 18,000 kW.

Reticulation is proceeding apace, but there is still a very large number of houses to be connected. The actual consumption of power per house has been calculated at 20 kWh per month, and on this basis reticulation of each additional thousand houses only involves an extra 500 kW per day on the main load. The heaviest item before the Auckland Power Board at the moment is the replacement of portions of the heavy city mains, which have developed faults as a result of overloading as well as other causes, and the introduction of the heavier cables will be proceeded with as soon as the necessary material comes to hand. The estimated profit of the Board for the past twelve months was £13,000.

Lake Coleridge Record Overload.

The growing popularity of electricity is nowhere better exemplified than in the case of the Lake Coleridge plant supplying the city of Christchurch. The nominal capacity of the plant is 12,000 kW, but the maximum overload capacity is estimated at 15,000 kW; for several weeks past the load has been in excess of the normal capacity. The heavy tax upon the capacity of the plant is having the effect of spurring on the duplication works, which, it is said, will only meet the requirements for a limited period. No doubt the progress of reticulation will be retarded to some extent as a result of the present heavy tax on the capacity of the existing plant, and every effort will be made to persuade the Government to sanction the erection of one or other of the secondary schemes in the general report—probably the Waimakariri project at either the Gorge Bridge site or at Otarama.

The Wairere Power Scheme.

Though one of the most recently formed Power Boards in the country, the Wairere body has lost no time in getting itself on to the Dominion's hydro map. The Wairere Falls, from which power is to be derived, is situated some twenty-two miles as the crow flies from the thriving King Country town of Te Kuiti. The scheme decided upon involves the provision of 1,600 h.p. from an available head of 60 ft. The estimated cost of the work is £38,500, and a loan for this amount is being issued.

The policy of the Board is to erect lines only in those localities where the guaranteed revenue is sufficient to render the work self-supporting. Guarantees have already been received to cover estimated working expenses over and above interest and sinking fund.

The scheme is considered one of the most economical projects in the whole of the Dominion scheme, and the vigour and keenness with which the project has been pursued augurs well for the success of the undertaking.

Electricity Supply in Great Britain.—V.

Berkshire and Oxfordshire.

FROM a glance at the map of the above counties, reproduced from the 1917 Boundary Commission Maps by permission of the Controller of H.M. Stationery Office, it will at once be evident that there are many acres of "unoccupied areas" in both counties waiting to be "exploited" by some enterprising group of persons or companies (local authorities apparently do not favour the grouping policy—from this point of view, at any rate).

We do not propose at this stage to discuss these areas from an engineering standpoint, but would like to refer those interested to the scale of miles, and ask them to compare some of the distances between the various towns with the distances between towns which are connected in other countries.

For the present our purpose is to show which are the occupied or applied-for areas by hatching these portions on the map.

In addition to the Metropolitan Electric Supply Co., Ltd. (which has bulk supply powers in the Borough of New Windsor and the Rural District of Windsor), there are 16 other undertakers, 13 of which are companies, whose areas of supply are wholly or partly included in this map. The following is the list:—

Local Authorities.

Maidenhead Corporation.
New Windsor Corporation.
Witney Urban District Council.

Companies.

Abingdon Electric Supply Co., Ltd.
Ascot District Gas & Electricity Co.
Banbury & District Electric Supply Co., Ltd.
Chipping Norton Electric Supply Co., Ltd.
Cookham & District Electricity Corporation, Ltd.
Oxford Electric Co., Ltd.
Reading Electric Supply Co., Ltd.
Thames Valley Electric Supply Co., Ltd.
Urban Electric Supply Co., Ltd.
Wantage Electric Supply Co., Ltd.
Whitchurch & Pangbourne Electric Supply Co., Ltd.
Windsor Electrical Installation Co., Ltd.
York Town and Blackwater Gas Co.

The 1921 Census gives the following particulars of the Administrative Counties of Berkshire and Oxfordshire and the associated County Boroughs:—

Acres.	Persons.	Resident families.	Buildings not containing dwellings.
943,050	484,436	114,477	8,213

Since these Boundary Commission maps were prepared in 1917, the following alterations have been made:—

(1) The Parishes of All Hallows, St. Leonard, St. Mary-the-More, and St. Peter have been united to form the new Parish of Wallingford, which is co-extensive with the Borough of Wallingford.

(2) The Borough of New Windsor has been enlarged by the inclusion of the Parish of Clewer Without.

(3) The Parishes of Pishill and Stonor, in Henley Rural District, have been united to form the new Parish of Pishill with Stonor.

(4) The alteration to parishes, &c., in the City of Oxford, made under the Oxford Corporation Act, 1925, does not take effect until April 1st, 1926.

London and Home Counties Electricity District.

As previously mentioned in "Electricity Supply in Great Britain—III," we are not reproducing a map of the County of London or of Middlesex, but maps of the other six Home Counties have now been published in this series.

In this connection we may point out that a map of the London and Home Counties Electricity District has just been published, and is now obtainable from H.M. Stationery Office or through any bookseller (price 3s. net). It is a small-scale copy of the map deposited at the offices of the Electricity Commissioners, showing the boundary of the District as defined in Section 1 of the Schedule to the London and Home Counties Electricity District Order, 1925, which reads as follows:—

Constitution of District.

"The following areas all as constituted at the date of the commencement of the Order giving effect to this Scheme (hereinafter called "the date of the Order"), namely:—

The Administrative County of London, that is to say, the City of London (including the places known as the Inner Temple and the Middle Temple) and the Metropolitan Boroughs of Battersea, Bermondsey, Bethnal Green, Camberwell, Chelsea, Deptford, Finsbury, Fulham, Greenwich, Hackney, Hammersmith, Hampstead, Holborn, Islington, Kensington, Lambeth, Lewisham, Paddington, Poplar, St. Marylebone, St. Pancras, Shoreditch, Southwark, Stepney, Stoke Newington, Wandsworth, Westminster and Woolwich;

The Administrative County of Middlesex;

The County Boroughs of Croydon, East Ham and West Ham;

So much of the Administrative County of Berks as comprises:—

The Municipal Borough of New Windsor;

The Parish of Old Windsor in the Rural District of Windsor;

So much of the Administrative County of Buckingham as comprises:—

The Urban Districts of Beaconsfield, Eton and Slough;

The Rural District of Eton;

The Parishes of Amersham, Chalfont St. Giles, Chalfont St. Peter's, Chenies and Penn; Coleshill Hamlet and Seer Green Chapelry in the Rural District of Amersham;

So much of the Administrative County of Essex as comprises:—

The Urban Districts of Barking Town, Brentwood, Buckhurst Hill, Chingford, Epping, Grays Thurrock, Ilford, Leyton, Loughton, Romford, Tilbury, Waltham Holy Cross, Walthamstow, Wanstead and Woodford;

The Rural Districts of Billericay, Epping, Ongar, Orsett and Romford;

So much of the Administrative County of Hertford as comprises:—

The City of St. Alban;

The Municipal Borough of Hertford;

The Urban Districts of Barnet, Cheshunt, Chorleywood, East Barnet Valley, Harpenden, Hoddesdon and Ware;

The Rural Districts of Barnet, Hatfield, Hertford, St. Alban's, Ware, and Welwyn; the detached part (lying between the Rural Districts of Ware and Epping) of the Parish of High Wych in the Rural District of Hadham;

The Parish of Flaunden in the Rural District of Hemel Hempsted;

§ So much of the Urban District of Rickmansworth and the Rural District of Watford as are not included in the authorised area of supply of the Corporation of Watford as constituted at the date of this Order;

So much of the Administrative County of Kent as comprises:—

The Municipal Boroughs of Bromley and Gravesend;

The Urban Districts of Beckenham, Bexley, Chislehurst, Crayford, Dartford, Erith, Northfleet, Penge, Sevenoaks, and Sidcup;

The Rural Districts of Bromley and Dartford;

The Parishes of Brasted (excluding the detached portion), Chevening, Dunton Green, Halstead, Kemsing, Otford, Riverhead, Seal, Sevenoaks Weald, Shoreham, Sundridge and Westerham in the Rural District of Sevenoaks;

So much of the Administrative County of Surrey as comprises:—

The Municipal Boroughs of Guildford, Kingston-upon-Thames, Reigate, Richmond and Wimbledon;

The Urban Districts of Barnes, Beddington and Wallington, Carshalton, Caterham, Chertsey, Coulsdon and Purley, Dorking, East and West Molesey, Egham, Epsom, Esher and the Dittons, Ham, Leatherhead, Merton and Morden, Mitcham, Surbiton, Sutton, The Maldens and Coombe, Walton-upon-Thames, Weybridge and Woking;

The Rural District of Epsom;

The Parishes of Bisley, Byfleet, Pyrford and Thorpe in the Rural District of Chertsey;

The Parishes of Dorking Rural, Effingham and Mickleham in the Rural District of Dorking;

The Parishes of Addington, Bletchingly, Chelsham, Crowhurst, Farleigh, Godstone (except the detached portion), Limpsfield, Oxted, Tandridge (except so much of the said parish as lies to the south of an imaginary straight line drawn from the point where the western boundary of the said parish joins the southern boundary of the Parish of Godstone to the point where the eastern boundary of the said parish

joins the southern boundary of the Parish of Crowhurst), Tatsfield, Titsey, Warlingham and Woldingham in the Rural District of Godstone;

The Parishes of Artington, East Clandon, East Horsley, Merrow, Ockham, Pirbright, Send and Ripley, West Clandon, West Horsley, Wisley and Worplesdon; and part of the Parish of Compton in the Rural District of Guildford;

The Parishes of St. Martha (Chilworth) and Shalford in the Rural District of Hambledon; and

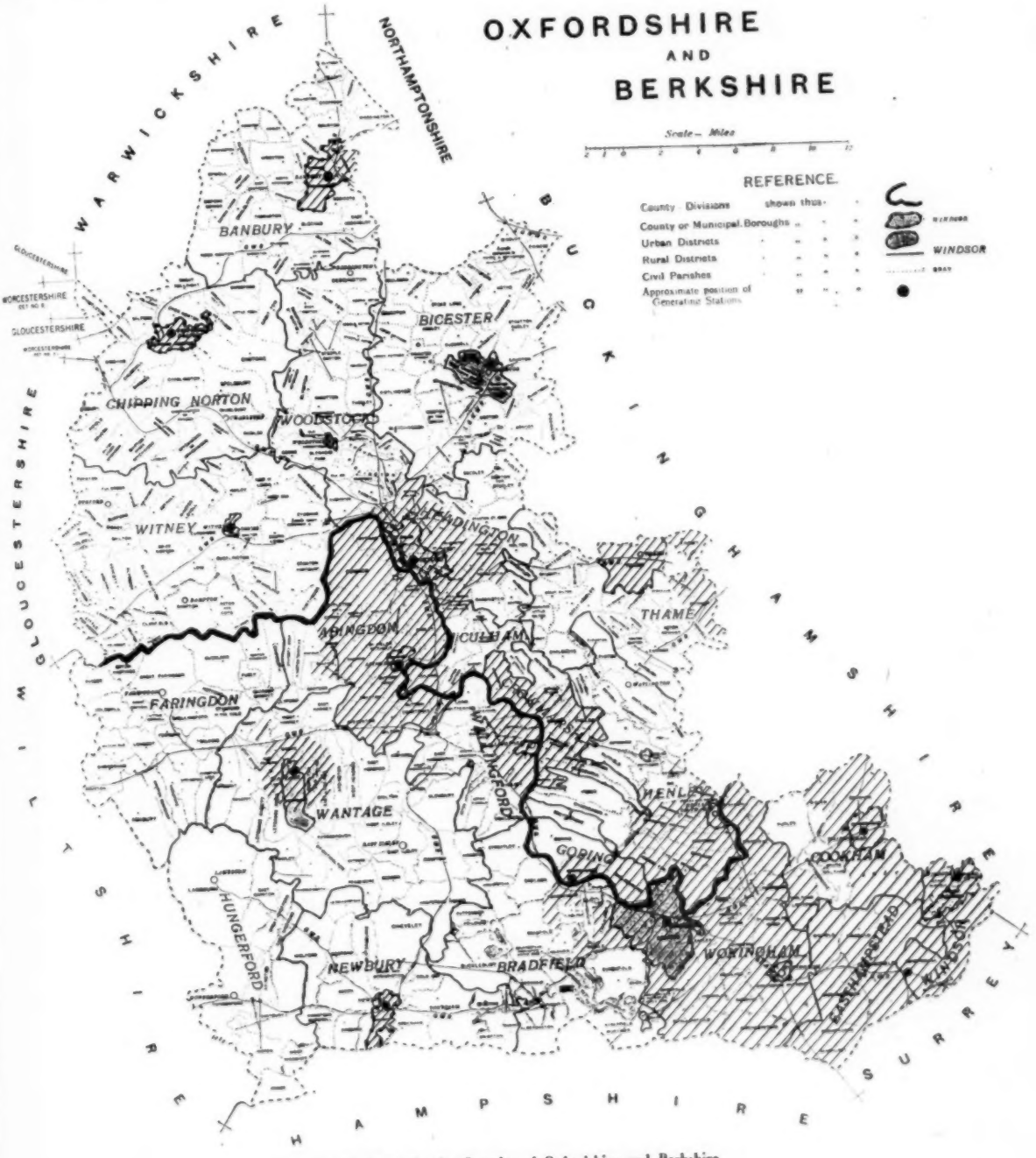
The Parishes of Betchworth, Buckland, Chaldon, Chipstead, Gatton, Merstham, Nutfield and Walton-on-the-Hill; and Kingswood Liberty in the Rural District of Reigate,

shall be constituted a separate electricity district for the purposes of the Electricity (Supply) Acts, 1882 to 1922, by the name of the London and Home Counties Electricity District, which District is more particularly delineated on the map deposited at the offices of the Commissioners and signed by the Secretary to the Commissioners. In case of any difference arising as to the boundary of the said District, the boundary shown on the deposited map shall prevail."

§ It should be noted that no part of the Urban District of Rickmansworth, as shown on the 1917 Boundary Commission Map of Herts., which we have reproduced, is included in the authorised area of supply of the Corporation of Watford.

The portion of the Rural District of Watford included in the authorised area of supply of the Corporation of Watford may be described roughly as follows:—The Parishes of Abbots Langley and Aldenham; and the Parish of Watford Rural except that part which lies to the south-west of an imaginary line drawn from the north-east corner of the Parish of Rickmansworth Rural (Detached No. 1) to the point where the railway cuts the southern boundary of the Parish of Watford Rural (Detached), as shown on the map which we reproduced.

In other words, the whole of Rickmansworth Urban District as shown on our map is part of the London and Home Counties Electricity District, together with the Parishes of Rickmansworth Rural and Sarratt, and that part of the Parish of Watford Rural (Detached) which lies to the south-west of the imaginary line described above.



Electricity Supply in the Counties of Oxfordshire and Berkshire.

SEVENOAKS.—In our issue of October 16th we said we believed the Sevenoaks and District Electricity Supply Co., Ltd., supplied no electricity in the part of its area outside Kent. This, we learn, was incorrect; the company's mains were extended into Surrey, and a supply was given throughout Oxted and Limpsfield in December, 1922.

Electricity Supply in Fulham. — With reference to our recent article on the extensions at Fulham electricity works, we are informed that Crosby feed water regulators are fitted to all the boilers in this station, including those just put in.

Modern Electric Cookers.

A Review of the Recent Improvements in Electric Cooking Stoves.

WHILE much remains to be done in improving the electric cooking stove before it can be claimed to be within the limits of perfection, much has been done in the past, especially of recent years, that has enabled the manufacturers to put upon the market at least a comparatively efficient apparatus whereby cooking by electricity has become a practical proposition in every class of residence throughout the country. We find manufacturers still divided in opinion as to the best design which should be adopted for the electric cooker; in fact some differ on the main principles of cooking by electricity. But there is ample evidence that all are working hard to bring about the common desire, the efficient and practical cooker; one which deviates as far as possible from recognition as an electrical appliance and becomes a practical cooking outfit. With the co-operation of several of the electric cooker makers of this country we have been able to gather much interesting information on the subject, and some idea of the trend of the present and the probable future developments.

Fig. 1.—Typical Construction of Modern Cooker ("Ghost" View).

The construction of the frame and exterior casing of the modern cooker is little altered from that of the past. The general tendency in design is to build a framework of cast iron, with the body or oven panelled inside and out with heavy-gauge sheet-steel plates; varying enamelled finishes add greatly to the attractiveness of many makes. Particular attention has been paid by most makers to the question of suitable adjustment for the oven door in order to reduce to a minimum the heat losses in that direction. The ventilation of the oven is a point which is receiving the serious consideration of the makers, it being the opinion in some directions that in the circulation of the air in the oven lies a great advantage which cooking by electricity holds over other cooking methods. In most cases, thermometers are installed on the doors. In some designs the oven door is arranged with its hinges at the bottom so that it may be lowered and used as a platform or shelf upon which the hot foodstuffs may be drawn for inspection, &c. The oven handle is so placed in these cases as to act as a support when the door is open. Fig. 2 shows a cooker made by Messrs. Coley & Swinnerton with a "drop" oven door. Several manufacturers have introduced rounded corners inside the oven, rendering the task of cleaning the interior a much easier one. An important feature in the construction of several modern makes of cookers is the hinged hob, fig. 1. This arrangement proves most valuable for both cleaning and repairing operations with regard to the boiler and the grill elements, and also the crown plate and the top of the oven generally. Many troubles have been caused in electric cooking ranges by the use of flexible wires, &c., for the internal connections, but in practically all the modern types, rigid bar connections have been adopted, suitably protected, and at the same time readily accessible.

It is perhaps a safe venture to suggest that by far the majority of electric cookers produced nowadays are

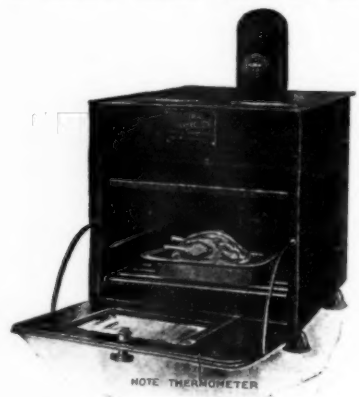


Fig. 2.—Small Oven, "Drop" Door.

either sold under special maintenance schemes or hired out by the supply undertakings, and it is a fact that many supply engineers have felt the need, in order to be able to continue and progress with their schemes of maintenance, of great improvements which would result in reducing the repairs bill and also in permitting the necessary repairs to be carried out more speedily and if possible, not on the consumers' premises. Most manufacturers have met this need by arranging the elements so that they can be easily removed and replaced in the case of defect without causing any appreciable disturbance or inconvenience on the site of the installation. Generally speaking, three methods of housing and fixing the elements have been adopted to fulfil this requirement: first, by attaching the elements to rigid bar supports by means of fixed bolts and wing nuts; secondly, by arranging the elements with plug and socket connections; and in the last case by building the various elements in unit form, housed in a metal frame, so that the whole unit can be removed or replaced simply by "dropping" it in a suitable provision in the main body of the range. The use of porcelain bushes for fixing the terminals, &c., was at one time a great source of trouble, experience showing that porcelain would neither stand the necessary temperatures nor the tightening up essential on the terminal and connection bolts, &c. It is particularly interesting to learn that Messrs. The Jackson Electric Stove Co., Ltd., are now using porcelain for the purposes specified. They claim that after many years of research they have obtained a specially prepared material which will stand up to the

treatment required, and they believe that at the present time they are unique in the use of porcelain in the direction indicated. Further, no mica is used anywhere on the Jackson stoves, the makers being of the opinion that in the past much trouble has been attributable to the employment of this substance, due to its absorbing various liquids which are spilt during cooking operations. Asbestos is used only where it is considered necessary, immediately under the hob plate, for the same reason. For the main connection from the switch box to the elements in this stove, the makers use multi-core cab-tire cable. An illustration of the housing of the elements and the general connections of the modern Jackson cooker is given in fig. 1. The hinged hob is shown in ghost view in two positions.

The modern tendency in the matter of heat control is to install 3-heat rotary regulating switches for the groups of elements for the oven and plates, &c., and to place these in a suitable box either on the side of the oven or under the hob plate. In the "Cosmos" cooker made by Metro-Vick Supplies, Ltd., all the connections are suitably protected, and at the same time readily accessible. By an ingenious arrangement, the whole of the wiring, complete with the fuses and switches, which are mounted on a panel at the side of the cooker, can be removed by undoing a few wing nuts. This is an important feature from a mass production point of view, and also with regard to maintenance schemes, as it allows for any improvements or alterations in the design of the cooker to be readily fitted to a cooker out in service.

A problem with which the electric cooker makers are confronted to-day is to provide one which can be adopted in the very limited space of the modern kitchenette, &c. To design a cooker of high efficiency with dimensions to please the maker is a vastly different proposition to designing one of the same efficiency within the dimension limits necessary for accommodation in the apartments mentioned. The Jackson No. 20b model (ELECTRICAL REVIEW, April 24th) is an excellent example of what is being done in designing cookers

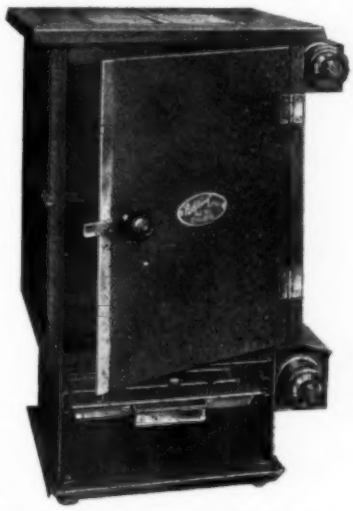


Fig. 3.—Cooker Designed for Limited Space.

for housing schemes, &c., where space is of vital importance. The overall width of this range is 23¾ in., and it has a total loading of 4,950 W for one boiling plate, one griller, and the oven. The "Belling" cookerette, fig. 3, is another good example; its overall width is 15½ in., and its total loading is 2,400 W for the oven and boiler-griller.

(To be continued.)

Three-phase Transmission Lines.

Rapid Preliminary Electrical Calculations with the Aid of Charts.

By GRAHAM ASHWORTH, B.Sc. (1st Class Hons. Eng.), Whitworth Senior Scholar.

THE accompanying charts have been prepared to enable the preliminary electrical calculations required for three-phase transmission lines to be made quickly by graphical methods. The following is a list of the symbols employed:—

I. Symbols.

L = Length of line in miles.
f = Frequency of circuit in cycles per second.
r = Resistance of conductor in ohms per mile.
R = rL = total resistance of one line in ohms.
x' = Reactance of one line to neutral in ohms per mile.
x = $50\,x'/f$ = ditto, ditto, at 50 cycles per second.
X = $x'L$ = total reactance of one line to neutral in ohms.
b' = Admittance of one line to neutral in micromhos per mile.
b = $50\,b'/f$ = ditto, ditto, at 50 cycles per second.
B = $b'L$ = total admittance of one line to neutral in micromhos.
R' = Resistance of one line (and transformers) per cent. of received voltage to neutral.
X' = Reactance of one line (and transformers) per cent. of received voltage to neutral.
S = $\sqrt[3]{(A\,B\,C)}$ = effective spacing of conductors in inches, where
A, B, C = Distances between each pair of conductors in inches.
d = Outside diameter of conductor in inches.
a = Area of (copper conductor) in sq. in.
E_s = Voltage to neutral at sending end.
E_r = Voltage to neutral at receiving end.
I = Load current.
$\cos\phi$ = Power factor at receiving end.
Y = $jB \cdot 10^{-6}$ = total admittance of one line in mhos.
Z = $R + jX$ = total impedance of one line in ohms.
j = $\sqrt{-1}$.
P = kVA delivered.
kV = (Standard) line kilovolts at receiving end.
w = Percentage resistance loss.
= Total line loss per circuit in kW × 100/kW received.

All logarithms to base 10.

II. Theory of the Charts.

Chart I.

Reactance.—

$$x' = 2\pi f\ (\text{constant} + 741 \log 2s/d)\ 10^{-6} \quad \text{.....(i)}$$

where

Constant = 102 for 7-wire cable.
= 89 for 19-wire cable.
= 80.5 for wire.

Taking the constant as 92.5 (an error in x of less than 0.7 per cent.), when $f = 50$, $x' = x$ and equation (i) may be written—

$$\log 2s - \log d = 4.30\ x - 0.125 \quad \text{.....(ii)}$$

Plotting log 2s and log d on rectangular axes, different given values of x in (ii) give different parallel straight lines at 45 deg. with the axes (with the same scales for log 2s and log d). These lines give an even scale with any transversal, as may be seen by giving log d a constant value in (ii).

Admittance.—$b' = 2\pi f\ 0.0388/\log 2s/d$ .....(iii)

and when $f = 50$, $b' = b$; equation (iii) may then be written—

$$\log 2s - \log d = 12.20\ b^{-1} \quad \text{.....(iv)}$$

Comparing (ii) and (iv)—

$$4.30\ x = 0.125 + 12.20\ b' \quad \text{.....(v)}$$

Thus, for every value of x, there is a unique value of b, and the x scale may be calibrated for b also.

Equation (v) may be written—

$$bx = 2.84 + 0.029\ b$$

and from the chart it is clear that the value of b in general lies between 3.5 and 6.0. Thus—

$$bx = 3.00 \text{ or } b'\ x' = 3.00\ f^2/50^2 \quad \text{.....(vi)}$$

with an error in practice of less than 2%.

Resistance.—Plotting the overall diameters of cable against the c.c. resistance of cable for both the B.S.S. No. 125, 1924, and the American Standards, it is seen that a curve may be drawn through the points with a maximum error of 2 per cent., and thus a resistance scale may be superimposed on the diameter scale, both for cable and wire. The three British 3-wire cables are exceptions to this curve. It should be noticed that the resistances are continuous-current, and are uncorrected for skin effect.

Critical line kV = 92.9 d log $2s/d$,

and this is the equation to the corona lines drawn on the chart.

Voltage Scale.—In practice, above 44 kV, a given voltage is usually associated fairly closely with a definite spacing; the voltage figures have been put on according to the following formula given by Guido Semenza in the Fifteenth Kelvin Lecture before the I.E.E. (see *Journal*, I.E.E., 1924, Vol. 62, p. 890), namely:—

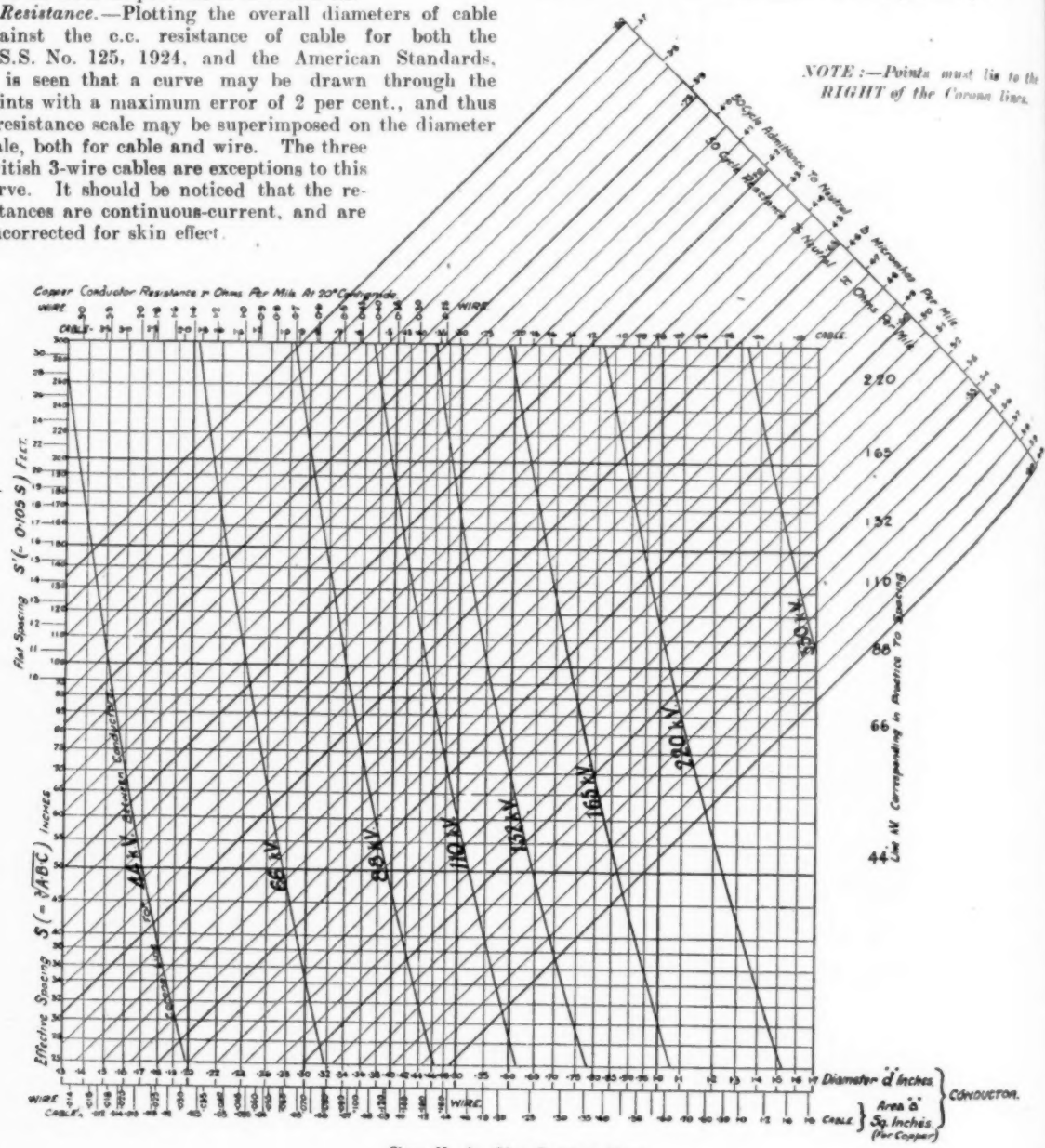


Chart No. 1.—Line Constants Chart.

Area.—Since for hard-drawn copper wire at 20 deg. C., area and resistance per mile are connected by the expression—

$$a.r = 0.0445 \text{ in.}^2 \text{ ohms},$$

it follows that area scales may also be superimposed on the diameter scales.

Corona.—The corona lines are plotted from Peek's equation for disruptive critical volts in fair weather—

$$\text{kV to neutral} = 2.302\ m.g.k.\ d/2 \log 2s/d. \quad \text{(vii)}$$

Taking

m = irregularity factor = 0.87 for cables,

g = disruptive gradient of air = 53.6 r.m.s. kilovolts per inch,

k = factor for barometric pressure and temperature = unity at 29.92 in. of mercury and 25 deg. C.,

equation (vii) becomes

$$\text{(Line) kV} = 3.14\ s, \text{ where } s \text{ is in cm.,}$$
$$\text{or kV} = 1.235\ s \text{ with s in inches.}$$

Line Capacity.—With no load at the receiving end,

$$\text{kVA} = 3\ E_s\ I/1{,}000 \text{ where } I = E_s B\ 10^{-6} \text{ amps. leading,}$$

i.e., $\text{kVA} = B\ (\text{kV})^2/1{,}000$.

ACCURACY.

The results for x and b have a maximum error of about 0.7 per cent. (See above.)

The chart values for r have a maximum error of 2 per cent.

Note.—When this chart is in constant use, it is advisable that diameter lines should be ruled on it corresponding to wire and cable commercially obtainable.

Chart II.

Scales.—From the vector diagram for regulation, neglecting capacitance,

$$(100 \sin \phi + X)^2 + (100 \cos \phi + R)^2 = (100 + \text{regulation in } \%)^2.$$

The vertical scale is even, and the

Value of horizontal line $= 100\ (1 \pm \sin \phi)$.

The horizontal scale, to give a suitable type of chart, is spaced so that the regulation is proportional to (distance of regulation line from zero line)^2.

The curved lines are—

$$100 \cos \phi + R = \text{constant}.$$

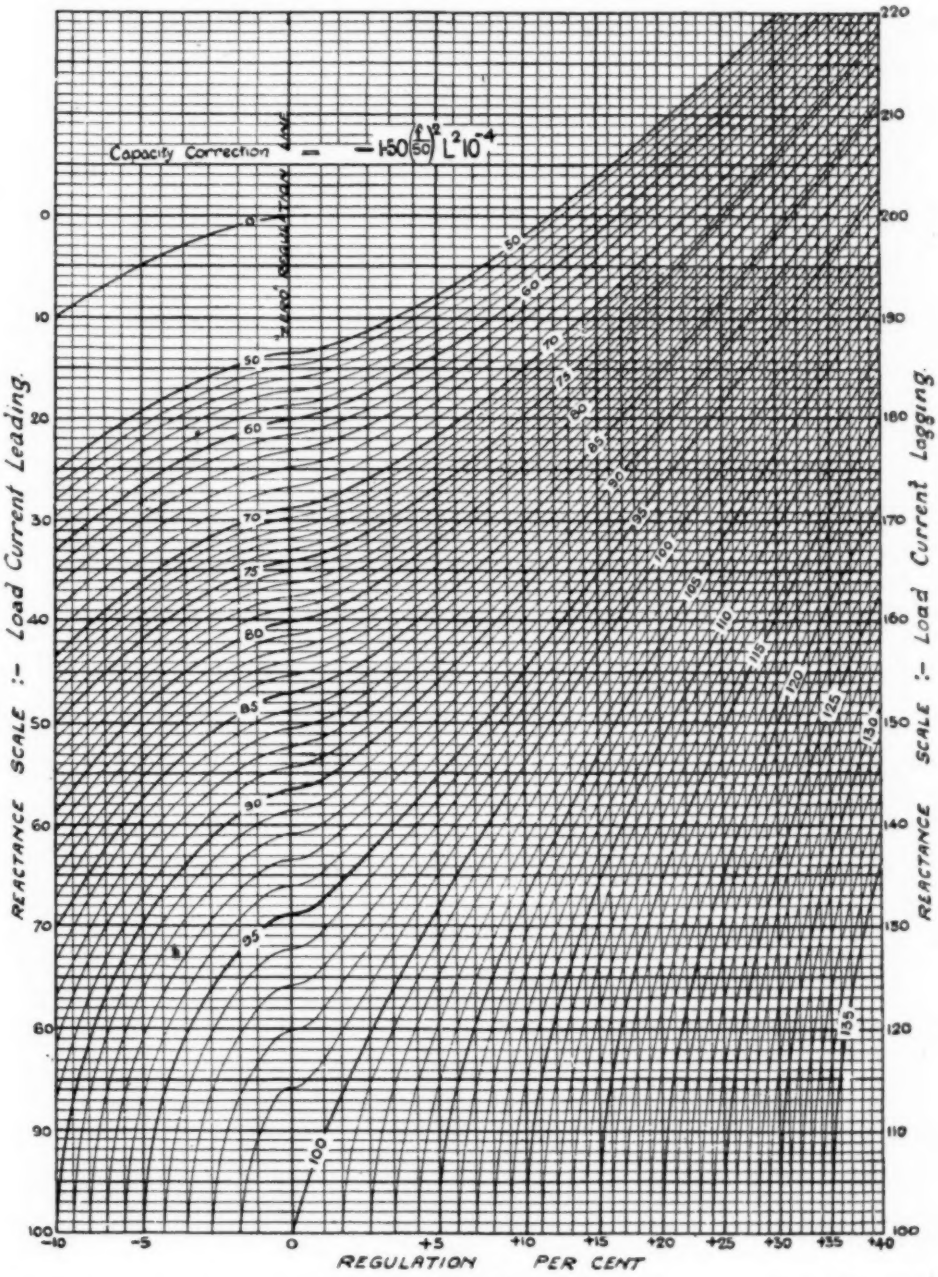
rigid mathematical solution of a line with distributed resistance, reactance, admittance, and leakance, is—

$$\text{Regulation} = (E_s - E_r)/E_r = YZ/2 + Y^2Z^2/24 + \text{----} + IZ/E_r \cdot (\cos \phi \pm j \sin \phi)\ (1 + YZ/6 + \text{----})$$

The chart gives, as accurately as it is drawn (*i.e.*, with a maximum error of about 0.1 per cent. on the regulation scale), the value of $IZ/E_r \cdot (\cos \phi \pm j \sin \phi)$, and so the important correction for capacity is—

$+ YZ/2 = + \frac{1}{2} j B 10^{-6}\ (R + jX)$, assuming zero leakance,

$= -\frac{1}{2} BX 10^{-6} + \frac{1}{2} j BR 10^{-6}$.



Example.—Determine the regulation of a circuit consisting of a line 105 miles (=L) long, with two banks of transformers, operating at a frequency of 50 cycles per second (=*f*) and a lagging power factor of 73%.

The total resistance drop of the line and transformers (R′) = 4.5%.

The total reactance drop of the line and transformers (X′)=21.0%.

Solution:—Cos ϕ = 73·0

Add R′= 4·5

79·5

The curve 75.0 meets the "zero" regulation line at a point measuring on the reactance scale:— 166.0

Add X′ = 21.0

187.0

At the intersection of curve 79.5 and horizontal line 187.0, read on the regulation scale + 18.0%

Capacity correction $= -1{\cdot}50 \cdot \left(\frac{60}{50}\right)^2 \cdot 105^2 \cdot 10^{-4} = -2.4\%$

True regulation of circuit = 15.6%

Chart No. II.—Ashworth Regulation Chart.

The chart may, of course, be used for the determination of both line and transformer regulation, and the zero curve has been added for transformers operating with pure capacity current.

Capacity Correction.—The formula obtained by a

The value of the term $\frac{1}{2} j BR 10^{-6}$ is negligible, since not only is it small for lines in which the capacity effect is important, but it is practically perpendicular to the "received voltage" vector, and the correction is

$$-\tfrac{1}{2} BX 10^{-6} = -\tfrac{1}{2} b'x' L^2 10^{-6}.$$

Equation (vi) gives the value of $b'x'$ as $3.00\ f^2/50^2$, and thus—

$$\text{Capacity correction} = -1.50\ L^2\ \frac{f^2}{50^2}\ 10^{-4}\ \%.$$

ACCURACY.

The accuracy obtainable by using the chart may best be demonstrated by the following table:—

Case.			I.	II.	III.	IV.	V.
Length of line ...	L	Miles	300	250	250	250	250
Frequency	f	Cycles/sec.	60	60	50	50	50
Apparent power received per circuit	P	kVA	18,000	19,000	100,000	100,000	100,000
Line voltage received	kV	Kilovolts	104	110	200	200	200
Resistance drop ...	R'	% of kV	17·5	8·3	6·5	6·5	6·5
Reactance drop ...	X'	% of kV	41·5	25·7	41·9	41·9	41·9
Load power-factor ...	cos ϕ	%	90 lagging	80 lagging	62 lagging	Unity	85 leading
Chart regulation ...	—	%	+37·0	+23·0	+37·5	+14·5	− 7·8
Capacity correction...	—	%	−19·5	− 9·4	− 9·4	− 9·4	− 9·4
Sum	—	%	+17·5	+13·6	+28·1	+ 5·1	−17·2*
Regulation by exact method ...	—	%	+17·7	+13·6	+28·4	+ 5·6	−15·6*

* The difference between these two results is chiefly due to the resistance drop of the capacity current, which has a greater effect at leading power-factor.

The pressure rise on no load is given (for the line only) by the correction for capacity derived above.

III. Formulæ

Voltage.—A purely empirical formula for voltages up to 110 kV is:—

Receiving end pressure $= \sqrt[4]{(PL/104)}$ line kilovolts.

Power Loss.—$a = PL/225w \cos \phi$ (kV)^2 square inches.

IV. Example.

Say, 20,000 kVA is to be delivered at 60 cycles and 75 per cent. lagging power factor over a distance of 105 miles, with a line resistance loss of about 4 per cent.

Formulæ.—With two circuits, $P = 10{,}000$ kVA, and receiving end pressure $= \sqrt{(10{,}000 \times 105/104)} = 100.5$, say, 110 line kV, since this is a standard.

Then $a = 10{,}000 \times 105/225 \times 4 \times 0.75 \times (110)^2 = 0.128$ square inch.

A convenient size of conductor is 7/.152, which has an area of 0.125 square inch; this gives a line power loss of 4.1 per cent.

Line Constants.—From Chart No. 1 the usual flat spacing for 110 kV is about 15 feet. Taking this value and a cable area of 0.125 square inch (noticing that there is no appreciable corona effect), the chart gives—

$r = 0.36$
$x = 0.680$
$b = 4.35$.

Whence $R = Lr = .36 \times 105 = 38$ ohms

$X = Lx' = 60/50 \times 0.68 \times 105 = 86$ ohms

$B = Lb' = 60/50 \times 4.35 \times 105 = 549$ micromhos.

Regulation.—Percentage resistance drop of line $= PR/10\ (kV)^2 = 3.1\%$.

Say for transformers' resistance (both banks) 1.4%, then $R' = 3.1 + 1.4 = 4.5\%$.

Percentage reactance drop of line $= PX/10\ (kV)^2 = 7.1\%$.

Say for transformers' reactance (both banks) 13.9%, then $x' = 7.1 + 13.9 = 21.0\%$.

From Chart No. II we see that the regulation from the low-pressure side of the transformers at the receiving end to the low-pressure side of the transformers at the sending end is 15.6%.

Voltage at sending end (referred to h.p. side) $= 110 \times 1.156 = 127.2$ line kV.

ZERO LOAD CONDITIONS.

Line Capacity.—$B\ (kV)^2/1{,}000 = 6{,}630$ kVA leading.

With both banks of transformers connected to the line, and each taking a magnetising current equal to 6 per cent. of the full-load current, the lagging kVA for magnetisation $= 10{,}000 \times .12 = 1{,}200$, and the load on generating plant $(6{,}630 - 1{,}200) = 5{,}430$ kVA leading.

Pressure Rise.

= Capacity correction + transformer regulation due to capacity current.

$= +2.4 +$ (reactance drop of one bank of transformers) × capacity kVA/full-load kVA.

$= 2.4 + 6.95 \times 5{,}430/10{,}000$.

$= 2.4 + 3.8$.

$= 6.2\%$.

Thus if the load is suddenly thrown off, the voltage across the transformers at the receiving end will rise to about $127.2 \times 106.2 = 135$ kV.

The Commercial Motor Exhibition.

Some Notes and Comments on Electric Vehicles and other Exhibits.

(*Concluded from page 727.*)

AN innovation at this year's Olympia show was a section devoted to modern plant for general garage purposes and appliances and tools for general service and repairs which was of business interest to owners of both small and large fleets of vehicles. The exhibits included such things as electrically-operated machine tools, drills, lathes, pumps, air compressors, and tire pumps; a kerbside remotely-controlled electric tire inflator, a magneto armature tester, and garage lighting equipment, &c.

The electrical items in another section, which had been allocated for the display of recent inventions affecting road vehicles, were chiefly of the nature of direction indicators and traffic signals.

Amongst the vehicles in the main section of the show, six wheelers were no longer regarded as freaks, air brakes were noticed on several makes of chassis, and a steam brake on one wagon; pay-as-you-enter 'buses were in evidence, whilst the safety of enclosed omnibuses was enhanced in nearly all cases by the provision of an emergency door.

Electric Vehicles and Trucks.

A new comer in the battery-driven vehicle market was the G. V. road tractor, a neat and powerful machine suitable for hauling loads of from 2 to 4 tons. It was fitted with a "Philco" battery, and was shown in conjunction with a specially-made 2-wheel trailer for the collection of offensive trade refuse bins. The body has been designed on sanitary lines, being sheet-metal-lined, and the loading line is just over 2 ft.

The General Vehicle Co., Ltd., had the only "all-electric" stand in the exhibition, and amongst the vehicles shown was a 2-ton standard chassis fitted with a box-van body for carriers. One of the special features of this type of vehicle for parcels delivery work is the easy accessibility of the interior of the body through the driver's cab, thus enabling the delivery work to be carried out entirely by the driver. A 3½-ton chassis was equipped with an all-wood steel-lined end-tipping body. The tipping gear, which is electrically operated, is of the "Edwards" hydraulic type. Three- and 2-ton Baker industrial electric trucks have a 2-wheel drive and 4-wheel steering. An auxiliary motor raises the loading platform, and is controlled by a limit switch, while the 10-ton tractor is capable of a speed with the rated load of 4 miles per hour; it is also supplied for various rail gauges.

The 3½-ton "electric" exhibited by Clayton Wagons, Ltd., was driven by a single motor, and the controller under the driver's seat provides five forward and two reverse speeds. The body was provided with end-tipping gear, of the run-back type, operated by an independent motor.

Electric Lighting and Starters.

All the leading manufacturers of electric lighting and engine-starting ignition equipment is exhibited in the accessories section. Electric lighting, not so long ago confined to private cars, was a feature of the "commercials" at the show, including steam wagons. Electrically-lighted taxi-cabs are now commonly seen, and several makers have produced generating sets which function without the aid of batteries, cut-outs, &c. Amongst these mention may be made of the C.A.V. and Simms machines, but one of the simplest was on the stand of the Villers Engineering Co., Ltd. This 12-volt generator differs from the more usual type, since it has a rotating field magnet and a stationary armature, which fact makes it possible to dispense with commutators, slip rings, brushes, and other parts usually liable to give trouble. The field magnet consists of a brass shell containing two laminated-iron pole pieces and two cobalt-chrome steel magnets. The armature is a laminated assembly in the form of a cross, on to the arms of which are wound four coils connected together to form two absolutely independent circuits. Twin cables are used to connect the lamps to the dynamo, one wire of each pair being fitted with a push-in connector, and the other with a terminal to be bolted on to the armature plate. This arrangement is an improvement upon the system of an earth return through the frame of the vehicle. The normal running speed is 3,000 r.p.m., but there is no flicker with speed reduction, and a special 2-way switch is incorporated in each lamp adaptor so that either or both lamps may be used as required. As each pair of coils is independent of the other, a breakdown in one circuit would not affect the other lamp. Although starting motors are not yet provided to any extent on the heavier type of commercial vehicle, they are now extensively used on the delivery-van pattern of chassis, and are also fitted to some passenger-carriers and taxis. Magneto ignition seems to be most favoured still, though occasionally a coil ignition system was to be seen, for instance, on the Reo and G.M.C. vehicles.

Other Features.

Methods of driving generators and motors differ, but an ingenious new starting-motor mechanism is a product of the C.A.V. Co. A worm and wheel are employed in conjunction with an automatic cone clutch, which can be accommodated in a surprisingly small space. It enables the designer to place the motor where he will, gives any gear reduction required, and operates in silence.

A practical method of mounting the head-lamps on the new A.E.C. chassis, each with a ball carried in a bracket having a spherical seat bolted to the radiator side bracket, permits individual adjustment of the lamps, as well as either lamp to be turned right round to facilitate work on the engine or elsewhere at night. A De Dion idea is to mount the radiator fan on the end of the dynamo shaft and to belt-drive the two together.

On the Spa "one-man" 'bus two electric bell-pushes were fitted, one on each side, for communicating with the driver, and a feature of the electric lighting and starter wiring system was that full access to the rear of the switchboard was obtainable by lifting the engine bonnet. On the Sentinel steam wagon the dynamo drive was noticed as having been converted from link belt to chain; the former method is used on the Clayton steamer, but a typical modern design is to drive the water pump, magneto, and dynamo in line or tandem by one shaft. A Fiat pay-as-you-enter 'bus was provided with a recessed electric lamp, which illuminated the step as the door was opened.

Refractory Formers for Electric Fires.

Their Radiant Efficiency: Interesting Test Results.

By C. H. S. TUPHOLME.

SOME interesting tests have recently been completed on the radiant efficiency of formers made of a new material, known as "Fosalsil moler," in comparison with a standard fireclay former in extensive use on electric fires. The two formers were rectangular in shape and recessed to take a heating spiral; they were similar in all respects, with the exception of their composition.

It is well known, of course, that in an electric fire the most desirable method of dissipation is by radiation, and the method which should be avoided, so far as is possible, is that of conduction. Heat conducted through the former to the frame and the back of the fire is, for all practical purposes, wasted and is undesirable. If two similar elements be mounted in formers exactly alike in shape, but differing in conductivity, the heat dissipated by conduction is less in the one case than in the other, the one with the greater conductivity losing more heat in this manner than the one with the less conductivity. In consequence, the temperature of the element in the latter will rise to such a value that the rate at which heat is then dissipated is equal to the rate of supply. The effect of this is that the latter element dissipates a smaller proportion of the total heat supply by conduction than the other element, and in consequence the greater is the proportion that must be dissipated by radiation and convection.

As the "Fosalsil moler" former had been found to have a lower heat conductivity than the standard fireclay former, it was to be expected that, if similar heating elements were fixed in the two, then, for the same consumption of electric power, the moler element would attain a higher temperature than the fireclay element, and the moler element would give out as radiant heat a larger proportion of the energy supplied to it than would the fireclay element. Tests were made to see if these conclusions were correct.

The power consumed in each case was 1,035 watts on a 200-volt circuit. The element temperatures, together with the element temperature of an element of one of the leading types of bowl fire, were:—

Fosalsil moler element	...	890 deg. C.
Standard fireclay element	...	830 deg. C.
Bowl-fire element ...	...	880 deg. C.

The results of the radiant heat tests were:—

	Intensity of radiant heat received normal to former at a distance of 48 ft. 5 in. Cals. per sq. in.	Ratio between normal radiant heats (Fireclay former = 100%). Actual.	Corrected for equal watts.
Fosalsil moler element	0.0177	112½	113½
Fireclay former ...	0.0157	100	100

The correction was necessary, as the power consumed differed slightly in this test, being 1,030 watts for the moler former and 1,040 watts in the case of the fireclay former.

The conclusions arrived at by the investigators are:—(i) The low conductivity of the moler is favourable to its use as a material for the construction of formers for electric heaters, and (ii) the figures obtained show that the manufacturers who have adopted it secure an immediate increase in the radiant efficiency of their fires of 13½ per cent., when compared with the ordinary fireclay formers.

Clear and Opal Lamps.—The General Electric Co., Ltd., has sent us a picture which illustrates in a remarkable manner the difference between the light given by a clear gasfilled "Osram" lamp and that produced by a "White Osram" lamp. The latter gives a diffused light which softens shadows almost to the point of total elimination, while with the clear lamp they are very hard.

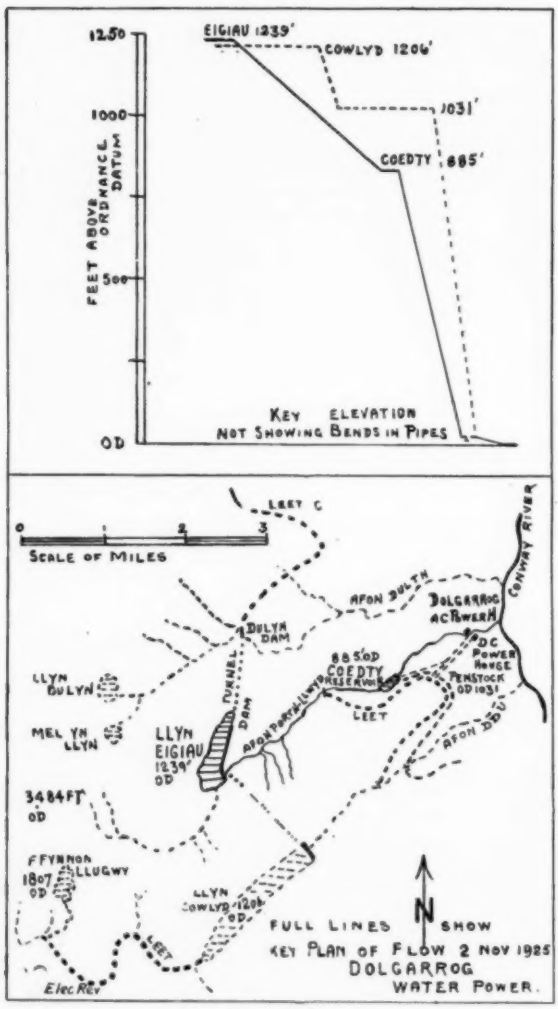
The North Wales Dam Accident.

An Account of an Investigation at Dolgarrog.

By THEODORE STEVENS.

The unexpected partial emptying of the stored water in Lakes Eigiau and Coedty which occurred on November 2nd with unfortunately fatal results—sixteen persons are dead or missing—was due to a washout beneath the dam at Eigiau.

Details of the development of hydro-electric power in 1908 were recorded in the Electrical Review at that time.* From the key map and elevation, which is too small to indicate bends in pipe lines, it will be seen that



Sketch Plan and Elevation.

the part of the present development affected by the accident is shown in full lines, and adjacent works are shown in broken lines. Eigiau lake's level was at 1,219 ft. above ordnance datum, and quoting from the issue referred to,* the dam is three-quarters of a mile long, and was built under the direction of Messrs. Harper Bros. & Co. and Messrs. Kincaid Waller Manville and Dawson by Messrs. Bott & Stennett, Ltd. It stores 160 million cubic feet up to its spillway at o.d. 1,239. The sluice is 25 ft. lower.

Leets, having a capacity of 3,500 cubic feet per minute, were constructed to collect the run-off, and a tunnel led water from the Dulyn dam into Lake Eigiau.

The dam varies in visible height from over 50 ft. at the river bed outlet to about 4 ft. at the bend in plan, but higher towards the tunnel end of the lake.

* Electrical Review, November 8th, 1908, pp. 803, *et seq.*

The opening beneath the dam structure through which the contents of about the top 20 ft. depth of the lake issued on the night of November 2nd is some 45 ft. long and 10 ft. or more deep. When this small remaining volume is drained off through a trench now being cut, the engineers will be able better to examine the ground on which the dam stands. At one end of this opening, boulder clay is visible above the water beneath the dam, and to the writer it was not apparent why a greater length of supporting boulder clay was not carried from beneath the dam by the rush of water.

The first intimation of the flood at the Dolgarrog power plant was at 9.30 p.m. on Monday, November 2nd, when a shift engineer and a driver were on duty in the "new," or alternating-current, power house, which then was carrying a load of 4,000 kilowatts (10,000 kilowatts installed plant).

In the "old," or direct-current, power house two others were on duty supplying 5,000 kilowatts to the aluminium furnaces.

After the first rush at the power house the water was noticed to recede, but Eigiau was discharging 85 million cubic feet total into the already full Coedty reservoir, so the water passed over, not only the spillway designed for maximum flood conditions, but over the crest of the Coedty dam, and it washed away a large part of the earth backing to this dam, exposing the 30-in. core of reinforced concrete, which could not withstand the pressure due to the velocity of the enormous flow (see illustrations elsewhere in this issue). Sir Douglas Fox and Partners were consulting engineers for the Coedty dam and subsequent works.

When this dam broke there was an additional 12 million cubic feet of water let loose. The Porthllwyd falls discharged this total of three million tons, and it is not surprising that all soil in its path was washed out and a vast weight of boulders thus denuded went forward and buried a considerable area.

The water-power service of electricity was cut off at Llandudno, Colwyn Bay, Conway, and Penmaenmawr from 9.30 p.m. on Monday until 4.55 p.m. on Tuesday. Llandudno got its own plant into service at 11.30 p.m. on Monday. Bangor and Carnarvon, having their own plants in service, were also able to restore supply on Monday evening. By 4.55 p.m. on Tuesday, November 3rd, full lighting supply over the whole area had been restored, as well as 70 per cent. of the power demand.

The area west of Penmaenmawr was not affected to an appreciable extent at any time.

Over the area all available sources of electricity are in process of being interlinked, and the Gresford Colliery, which has been feeding into this network since August 1st, 1925, was actually supplying at the time of the mishap, and has continued to carry the Wrexham load in conjunction with the Wrexham Corporation's steam plant, which was in reserve at the time of the mishap. Wrexham was "off" for two minutes. The Mersey Power Co. will be linked up by April, 1926.

With the exception of Colwyn Bay, every town in North Wales on the service has retained its former plant, but when the transmission system is completed, there will be no necessity for the smaller plants now retained in Bangor, Carnarvon, Llandudno, Rhyl and Wrexham.

The Cwm Dyli power house (outside the area of the key map) of 7,000 kVA capacity, with storage in Lynn Llydaw, has been continuously in service, and it could have maintained the supply on the Monday night had not the poles across the path of the flood been washed away.

The Dolgarrog Dam Burst and Flood Damage.

As we briefly reported last week, Llyn Eigiau, one of the natural lakes in the Welsh hills on the west side of the river Conway, which was converted into a reservoir about 17 years ago by the North Wales Power Co., undermined its embankment at 9.30 p.m. on November 2nd. The water thus released precipitated itself upon the north end of the village of Dolgarrog, and on its way to the River Conway demolished a long stretch of highway, a road bridge, and several houses, other buildings being damaged; 16 lives were lost.

Photopress] [*London.*

Fig. 1.—View Down the Pipe Line.

The flood swept through the Aluminium Corporation's works and the hydro-electric power houses, but, apart from the regrettable loss of life, the material damage seems to have been not so extensive as was at first reported. Fig. 1 is a view looking down the pipe line on to the Dolgarrog works, while figs. 2 and 3 show portions of the two dams. Other views of the damaged works are reproduced on page 783.

Photopress] [*London*

Fig. 2.—The Wash-out at Eigiau Dam.

Llyn Eigiau is about a mile long and 1,200 ft. above sea level, lying some four miles west of the village; the concrete dam is "L" shaped and in the middle of the shorter limb, the natural outlet of the lake, the Porthllwyd originates; it is near this spot that the wash-out is reported to have taken place. The water swept into the subsidiary Coedty reservoir, which is near the verge of the cliff above Dolgarrog, but the volume was too great and the lower dam failed to prevent the water falling 500 ft. almost perpendicularly from the edge of the table land on to the village below. According to Mr. H. J. Jack, managing director of the Aluminium Corporation and its allied companies, who was interviewed by *The Times* correspondent in the presence of General R. F. Legge, Treasury director of the North Wales Power Co., the accident is not to be described as a catastrophe for either manufacturing or electricity generating works. The damage to the high-level reservoir is comparatively slight. Electricity supply was restored from the generating station at Cwmdyli, near Beddgelert, and on November 3rd a small machine was running at Dolgarrog. The two pipe lines are intact, except that at the top end of the penstock dam a short length of branch pipe has been dislocated. Only four of the aluminium furnaces or baths exploded when the water reached them, and he estimated that all the material damage would be made good in four months' time.

Photopress] [*London.*

Fig. 3.—Breach in the Dam at Coedty.

The North Wales Power Co. purchases its power from the Aluminium Corporation and exercises the supply powers of the joint authority controlling the North Wales and South Cheshire Electricity District—the only such authority that has functioned under the Electricity Commissioners' scheme of reorganisation. A new distributing organisation is coming into operation in three months' time, and the accident will not affect the arrangements to any material extent.

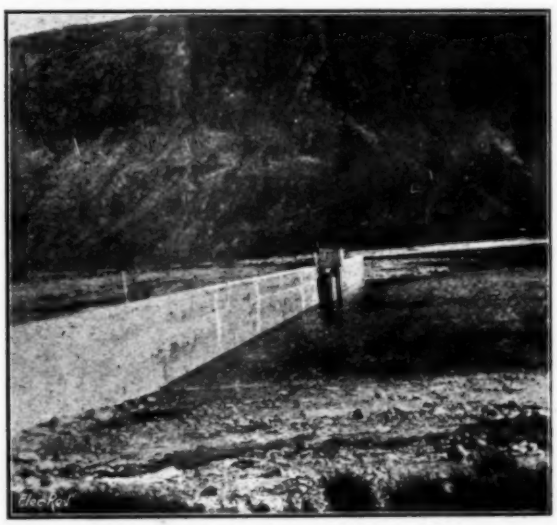


Fig. 4.—View of Part of the Dam at Llyn Eigiau.

(By courtesy of Mr. J. W. Griffith, M.Inst.C.E.)

D

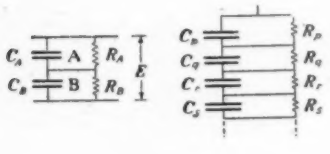
Dielectric Problems in High-Voltage Cables.

By P. DUNSHEATH, O.B.E., M.A., B.Sc., M.I.E.E.

(*Abstract of Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE three dielectric characteristics most generally considered in h.p cable work are a.c. losses, a.c. breakdown strength, and dielectric resistance (measured by d.c.), but the order of importance is a matter of opinion and the connection between the three not at all understood. For some time there has been a growing conviction that the phenomena displayed under the conditions employed for measuring the d.c. resistance are at the bottom of a.c. losses. For this reason prominence has been given in the paper to the consideration of dielectric absorption.

The correlation between a.c. and d.c. phenomena has been hindered in the past by the fact that d.c. resistance has usually been measured at voltages of 500 or less, whilst a.c. loss measurements have been carried out at from 10,000 and upwards and the uncertainty of the effect of voltage has made it impossible to bridge the gap between the two sets of published results. A.c. tests carried out under these conditions admittedly do not bring to light the phenomena connected with the ionisation of air entrapped in the dielectric, but the investigation of this factor separately is an advantage. The bringing together of a.c. and d.c. data for the same dielectric seems to be imperative for the fuller understanding of the complicated phenomena encountered. It does not take us the whole way, but it enables us, for example, to obtain a new conception of dielectric losses independent of "hysteresis." By the theory here put forward alternating dielectric losses are explained as I^2R loss, caused simply by a current flowing through a resistance as in other types of electrical loss, and the idea of dielectric hysteresis becomes unnecessary.



Figs. 1 & 2.—Model Dielectrics Illustrating Absorption.

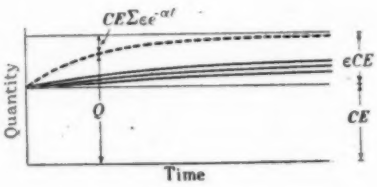


Fig. 3.—Effect of Time Constants.

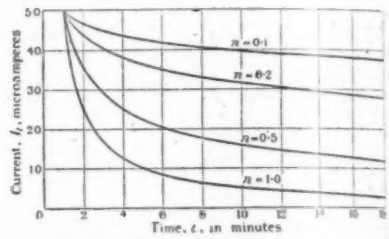


Fig. 4.—Empirical Absorption Curve, showing Effect of Varying n.

Dielectric Absorption (*Theoretical*).—"Electrification" has long been known in connection with the testing of gutta-percha cables, and it has recently appeared in a new form in connection with the testing of a.c. power cables with h.p. d.c. generated either by the Delon apparatus or by rectifying valves. If a cable for a working pressure of, say, 33,000 volts be charged up to 100,000 volts for a few minutes and afterwards short-circuited, it is not safe to remove the short-circuit for some time, as the residual charge absorbed by the cable will leak back and charge the conductor to a dangerous value. It is becoming increasingly evident that a.c. dielectric losses are largely the result of d.c. absorption, and the demands for the consideration of the claims of d.c. for high-voltage long-distance transmission are becoming insistent. For both reasons a summary of the underlying principles of absorption are called for.

Two main theories claim to explain in different ways the mechanism of dielectric absorption and residual charge. The first one, advanced originally by Maxwell, depends on the distribution of charge throughout a non-homogeneous dielectric. He considered the component capacities and resistances in the dielectric and showed that the distribution of potential under transient conditions is settled largely by the arrangement of component capacities, whereas under steady conditions it is fixed by the arrangement of component resistances. The time-lags of electrification and de-electrification are considered in this theory to be due to the time occupied in the rearrangement of potential between one of these conditions and the other.

In the second theory, advanced originally by Hopkinson and since elaborated by other writers, the phenomena are connected with the movement of the electron in the atom. Maxwell's original idea of a heterogeneous dielectric seems to be most useful for cable work, and by the use of this conception it is possible to build up a very simple theory which at the same time conforms exactly to the deductions of Pellat and Schweidler; moreover, it can be used not only for explaining dielectric absorption under d.c. conditions, but also as a basis for a simple conception of dielectric losses under a.c. conditions.

Two condensers and resistances connected as in fig. 1 approximate to a practical absorptive condenser. The ratio of the capacities must be different from the inverse ratio of the resistances, that is:—

$$\frac{R_A}{R_B} \neq \frac{C_B}{C_A}$$

Under steady conditions the potential of the centre point of the combination is settled by the ratio of the resistances, the capacities having no effect. Under transient conditions, however, such as occur at the instant of applying a difference of potential across the group, the potential of the centre point is controlled by the ratio of the capacities, and the resistances have relatively no effect. The potential distribution will be as shown in Table I, where E is the applied e.m.f.

At the instant of switching on, therefore, such an arrangement acts as a pure capacity taking a heavy momentary charging current. Immediately, also, redistribution of potential commences and requires further current, which dies away until, when steady conditions are attained, only that flowing through the resistances remains.

TABLE I.

Condition.	Potential difference across A.	Potential difference across B.
Steady	$\frac{R_A}{R_A + R_B} E$	$\frac{R_B}{R_A + R_B} E$
Transient	$\frac{C_B}{C_A + C_B} E$	$\frac{C_A}{C_A + C_B} E$

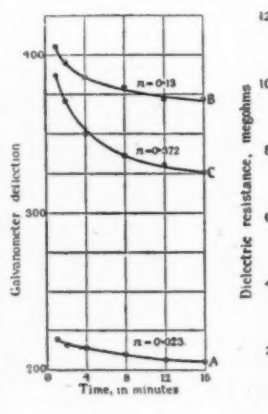
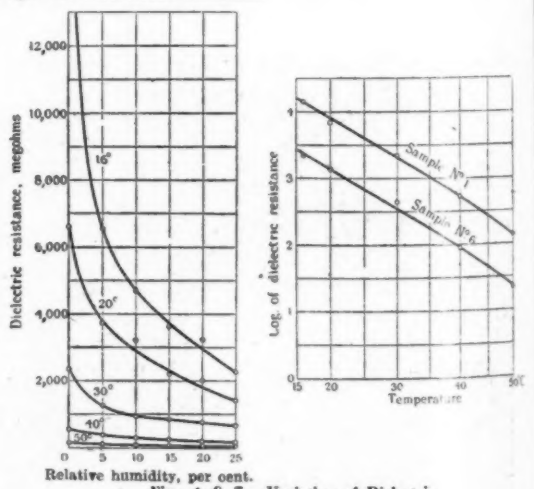


Fig. 5.—Cable Compound Charging Current.



Figs. 6 & 7.—Variation of Dielectric Resistance of Conditioned Celluloid.

When short-circuited, a sudden rush results in the total discharge of the smaller condenser and the taking from the other of an equal quantity. At this instant a quantity of electricity equal to the difference between the full charges of the two component condensers is set free and commences to discharge partly through its bridging resistance and partly through the other resistance component and the external circuit, the latter part representing the residual charge. If, after the initial short-circuit, the external circuit is opened, the discharge of the larger condenser which is still in progress charges the outside plates, giving rise to another phenomenon noted with absorptive condensers—the repeated reappearance of a charge on the plates after temporary short-cicuits. It is evident, then, that such an arrangement, in addition to giving all the charg-

ing characteristics of an absorptive condenser, also imitates the conditions during discharge.

Suppose that, instead of only two condensers and two resistances, we consider an infinitely large number of them as shown in fig. 2; we now obtain for the total quantity of electricity stored up to time t the following expression:—

$$Q = CE + CE\int \epsilon\,(1 - e^{-\alpha t})\,dt$$

At the instant of closing the circuit the charge CE enters the condenser. Immediately also an infinite number of additional charges commence to increase from zero at different rates, as indicated by the collection of curves in fig. 3. The dotted line represents the sum of these component curves and approaches asymptotically the ordinate CE $(1 + \epsilon)$. From the same considerations we obtain the following expression for the total current flowing after time t through the series of circuits with various time-constants:—

$$I_t = \frac{E}{R}\int_{\alpha=0}^{\alpha=\infty} e^{-\alpha t}\,d\alpha$$

This analysis does not lead to a formula which can be employed for the practical estimation of the current flowing in an absorptive condenser after a given period, so that we are compelled to fall back on an empirical expression. The most commonly used expression for the charging-current time characteristic is $I_t = I + At^{-n}$, where I is a true conduction current still flowing after infinite time; A and n are constants, the latter having a value less than unity, and the quantity At^{-n} represents the current supplying the absorbed charge.

Results already published, as well as the author's own experiments, show that this expression never does represent accurately the actual variation of current in a cable dielectric over any considerable period of time. It appears to be sufficiently accurate over short intervals (seconds) to make it useful in connecting the d.c. and a.c. characteristics of a dielectric, and if we adopt the convenient reservation that n itself varies with time, we can use the expression in the form given with considerable advantage both for analytical discussion and for the interpretation of practical results. Fig. 4 shows the relative shapes of current/time curves calculated for different values of n from 0.1 to 1.0 and, to anticipate for a moment, curves plotted from experimental results obtained on cables appear to start on one value of n and to change gradually with time to a different value. It is evident from fig. 4 that the 1-minute value is an imperfect indication of the nature of the dielectric. A number of cables may all have the same 1-minute value and yet have widely different characteristics depending on the value of n.

Two methods of determining the values of the constant from an experimental curve are worked out in an appendix, allowing for the presence of I in the formula $I_t = I + At^{-n}$. In view of the change of n with time which took place in all cable dielectrics so far examined, the determination of the constants from different finite parts of the curve may lead to different values of I, in some cases the early portion giving a negative value.

To sum up, it is evident that whether we are discussing the correct ratio to adopt between d.c. and a.c. pressure for high-voltage testing, comparing d.c. and a.c. losses for theoretical interest, attempting to show that a.c. losses are partly due to d.c. resistance, or any other of the similar problems that are receiving special attention to-day in connection with high-voltage cables, we cannot be too precise in our definition of the d.c. resistance. Although the whole phenomenon of absorption can be shown as above to be based on resistance within the dielectric, the value of this resistance is elusive.

Dielectric Absorption (Experimental).—Experiments by the author show that n may change considerably between, say, 15 seconds and 5 minutes, and, in addition, the final value of I to which the curve is approaching may be different at different times. In a curve, for instance, which ultimately approaches zero the application of the empirical absorption formula to the early part of the curve may lead to a negative value for I. Methods outlined in an appendix enable the values of those quantities to be obtained notwithstanding these vagaries.

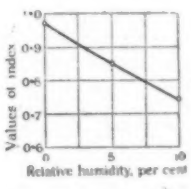


Fig. 8.—Variation of n with Humidity.

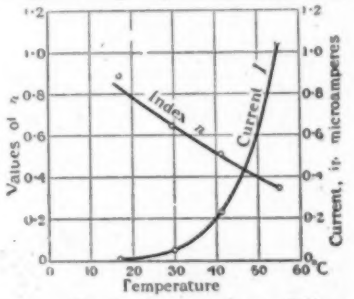


Fig. 9.—Impregnated-paper Cable; Variation of n and I with Temperature.

Quite a large number of tests have been carried out on various types of impregnated-paper cables, and fig. 5 shows the charging currents obtained on three samples of oil at 40 deg. C. The samples were mixtures of two ingredients used in the manufacture of cables. In order to investigate the effect of moisture content on dielectric absorption it is, of course, necessary to choose a dielectric in which the moisture content can be conveniently controlled during the test; the selection ultimately fell on celluloid as being homogeneous, subject to humidity conditions and yet changing so slowly as to make handling during the tests practicable.

Fig. 6 shows the definite connection between the dielectric resistance and the relative humidity of the atmosphere under which the samples were stored. In fig. 7 the logarithm of the dielectric resistance of the extreme cases is plotted against temperature (the other cases lie between) and the results indicate that the law connecting dielectric resistance and temperature is the same for all humidities: it is $R_\theta = R_0\, e^{-0.05\,\theta}$ where R_θ = resistance at θ°C.; R_0 = resistance at 0°C.; and θ = temperature, °C.

The variation of the index n with the relative humidity of the controlling atmosphere is shown in fig. 8; the presence of moisture lowers the value of n, and it seems probable that if No. 1 sample had been perfectly dried its index would have been unity.

The values of n and I are plotted in fig. 9, from which it will be seen that raising the temperature of a paper cable reduces the value of the absorption index.

(To be continued.)

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Safeguarding of Industries Act.—We have received the following communication from Messrs. Leopold Farmer and Sons:—"It may be of interest to your readers to learn that whenever any move is made by the Government for protection of trade, this is immediately reflected by the inquiries made in England from foreign firms regarding conditions for manufacturing in this country. Since there is a new movement on foot to extend the scope of the Safeguarding of Industries Act for the better protection of English manufacturers, we are able to report many inquiries, and negotiations in hand with foreign firms to establish works in this country. There is no doubt that should they decide to locate themselves here, they would not only be able to use the trade mark, 'Made in England,' but obtain preference in rates in shipping to our Colonies. Messrs. Citroën, makers of motor-cars, have definitely acquired a manufacturing property at Slough, and other well-known motor firms and tire manufacturers are negotiating for areas of land on which to build works. If the Safeguarding of Industries Act is extended, a good many other firms will have to operate here. Our experience of the alteration in the Patents and Designs Act, 1909, which compelled the foreign holder of an English patent to manufacture it here, resulted in the establishment of some 100 new works in this country, in addition to the extension of English manufacturers' plants for manufacturing the patents on licence. These operations absorbed additional labour, helped to develop new areas, provided increased rates to local authorities and were of considerable financial benefit to the country as a whole."

The Shannon Scheme Dispute.—Our Dublin correspondent states that the return of Mr. McGilligan, the Free State Minister of Industry and Commerce, from the United States, will probably lead to the adoption of stern measures to end the dispute which is holding up the Shannon hydro-electric scheme. A number of members of the National Ex-Servicemen's Organisations have accepted employment at Limerick with the contractors, Messrs. Siemens, Schuckert & Co., while it is stated that the firm has in hand over 5,000 applications from men who are willing to work on the scheme if permitted to do so. A further 60 German engineers and mechanics recently arrived at Limerick and a German vessel which was unable to discharge its cargo for some time has now been unloaded and has returned.

Football.—On Saturday last the Dussek Bitumen Co., Ltd., defeated the Union Cable Co., Ltd., at Dagenham, in the third round of the London Junior Cup.

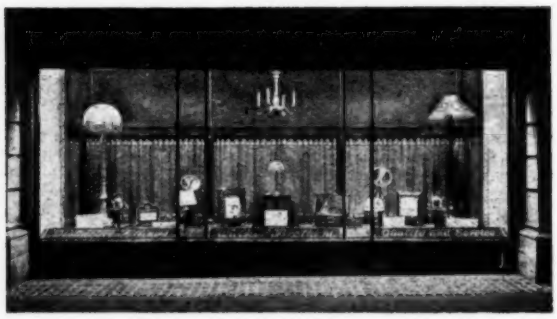
Metropolitan-Vickers Colliery Winders.—The Metropolitan-Vickers Electrical Co., Ltd., recently claimed that it had supplied 78 per cent. of the electric winders installed in the Northumberland and Durham coalfields. Since then further orders have been received from this area, other British coalfields, and a number of South African mines.

An Important Canadian Contract.—The *Electrical News* (Toronto) reports that the Canadian Westinghouse Co., Ltd., has received a contract for the electrical equipment of a pulp and paper mill at Peribonca, Quebec, the construction of which is estimated to cost 3½ million dollars.

Commercial Electrical Travellers.—A well-attended meeting of the Electrical Trades Commercial Travellers' Association was held on October 30th at the E.L.M.A. Rooms, Savoy Hill. The subject under discussion was "Salesmanship," and Mr. V. Dale's paper, to which we refer more fully on another page, was much appreciated. Mr. A. E. Joyce presided, and Mr. H. Whynn Roberts, vice-president, opened the discussion. The next social event will be held on Saturday, November 21st, at the Manchester Hotel, and will take the form of a whist drive and concert.

The E.L.M.A. Design Course.—A number of contractors who attended the last illumination design course arranged by the Electric Lamp Manufacturers' Association have, through the secretary of the Electrical Contractors' Association (Mr. L. G. Tate), expressed their thanks to the Lighting Service Bureau for the full and useful information put before them at the course.

Shop-window Lighting.—The accompanying illustration is a night view of the window of Messrs. Walker Bros., electrical engineers, Temple Row, Birmingham, and, as the picture



A "Siemens" Window.

shows, is a very dignified display. The lighting was carried out with "Siemens" shop-window reflectors and gasfilled lamps, and all the electrical domestic appliances displayed are "Siemens-Xcel" apparatus.

City Electricity Charges.—At last week's meeting of the Corporation of the City of London, Mr. Deputy Sandle stated that while the Charing Cross Electricity Co. had reduced the price of energy for heating and cooking, there was also room for a reduction in the charges for lighting and power. The reductions made in response to representations by influential City bodies only affected a small proportion of the consumers in the City. Although the company stated that the high prices were due to increased rates on its premises, it was now paying £11,146 as against £16,118 in 1921. The maximum price of 6d. per kWh for lighting compared unfavourably with the charge in other parts of London and the larger provincial cities. Mr. Sandle quoted Cape Town as an example of a provider of cheap electricity in spite of the difficulties with which the Municipality had to contend. He regretted that the Corporation had abandoned its option to purchase the undertaking. If justice could not be got for City consumers, Parliament should be asked to pass a Bill allowing the City to run an undertaking of its own, or to obtain supplies from some other authority. Mr. J. R. Pakeman said that it had been considered that it would be unwise for the Corporation to exercise its right to purchase the undertaking. There were explanations in several respects of some of the statements made by Mr. Deputy Sandle.

Eventually the Corporation passed Mr. Deputy Sandle's motion, and it was decided to send copies of the resolution to the two electricity supply companies, the Minister of Transport, and the Electricity Commissioners.

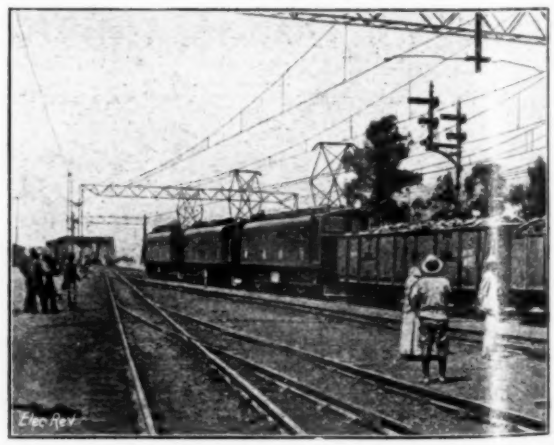
The Timber Market.—Our timber trade correspondent informs us that the market for wood for general utility work is much firmer than when we reported on it a few weeks ago. Stocks are still fairly large, but the consumption continues to steadily increase, and the general improvement of trade will have much to do in still further enlarging the demand for wood for all building construction, and for box and packing case work. A further influence on the steadiness of prices is that the meteorological conditions in the north of Europe foretell an early close of navigation. If such prove true, much of the timber that would otherwise have come forward to this country will over-winter at the shipping ports, and the fairly large stocks would thus be only moderate to carry us through the winter months. In poles for wireless work the market is fairly reasonable, and now that we have arrived at what must be considered the busiest time for the wireless form of entertainment and study, the demand for poles should increase. Those firms who manufacture woodwork from hardwoods will also find that the market is steadily firming up. This is especially so for teak, as well as hardwoods from the United States, such as mahogany, ash, oak, maple, walnut, and satin-walnut, for all of which shippers are asking firm rates. Mahogany from British Honduras, Central Europe, and West Indies and West Coast of Africa is also a very strong market, of which those firms who are manufacturing woodwork in that material should take note.

The British Industries Fair.—Over 50,000 invitations from the Department of Overseas Trade for the forthcoming British Industries Fair at the White City, London, and Castle Bromwich, Birmingham, are being issued to overseas buyers in all parts of the world, apart from the very large number of invitations which will shortly be addressed to home buyers. The Department of Overseas Trade has compiled, within recent years, an exhaustive index of buyers of all classes of goods exhibited at the Fair. This index, to which additions are constantly being made, comprises at present some 50,000 names of overseas buyers. Of the more important markets there are some 2,000 firms in Australia and New Zealand on the list of the Department, 2,168 in Canada and Newfoundland, over 3,000 in South America, and 5,000 in the United States. To all firms on this list and to any other firms that the exhibitor may indicate, a series of two letters is sent in the appropriate language. Further, the overseas officers of the Department, who are stationed in every country of the world, and who have in their possession a list of the buyers in their particular districts, have been requested to notify the Department of all buyers who intend visiting the Fair, and, if possible, the date of their arrival in England, so that, as far as possible, arrangements may be made for their reception and entertainment. All who do not receive their invitations within the next few days should apply direct to the nearest British representative, Trade Commissioners in the Dominions and Colonies, and Commercial Secretaries or Consuls in other countries, or the Exhibition Branch, Department of Overseas Trade, 35, Old Queen Street, S.W.1.

Local Exhibition.—HEBDEN BRIDGE.—An exhibition of electric lighting and domestic labour-saving appliances, held under the auspices of the local electricity department, was opened on October 26th, at the Co-operative Hall, by Mr. E. Hartley, chairman of the Electricity Committee of the District Council, with the Chairman of the Council (Mr. A. Sutcliffe) presiding. The exhibition was held in connection with the celebration of the 'coming-of-age" year of the local electricity undertaking, and the opener made reference to the great progress in electricity for domestic purposes and in that undertaking particularly.

Patent Application.—Application has been made for the restoration of Patent 173,529 of 1921, granted to Quarz-Lampen-Gesellschaft m-b-H. for "Mercury Vapour Apparatus and more especially Quartz Lamps."

More Electric Locomotives for South Africa.—As was briefly stated in our last issue, a contract for 17 locomotives, with spares, totalling upwards of £250,000 in value, has been placed by the South African State Railways with the Metropolitan-Vickers Electrical Co., Ltd. The new locomotives will be duplicates of 78 locomotives originally ordered from the same company in 1922 and put into commission during the last two years. The locomotives are of the "AA+AA" type, each weighing 66½ tons, having been equipped with four 300-h.p. motors, and giving 40,000 lb. maximum and 16,400 lb. continuous tractive effort. The track is a very difficult one. The gauge is only 3 ft. 6 in., and the gradients are heavy, since the altitude of the line varies between 2,200 and 5,000 ft. above sea level, and the track winds with many sharp curves. For these reasons, and as the loads to be hauled are very heavy,



Metropolitan-Vickers Locomotives in South Africa.

provision is made for three locomotives to be attached to each train. The locomotives are arranged for multiple-unit control from a single cab, and also with this system of control regenerative braking is provided for the first time in large-scale operation. We understand that the design has proved entirely satisfactory both in the special tests to which the locomotives were submitted and in actual service. Power is supplied to the locomotives at 3,000 V direct current from overhead contact wires, and the standard track return is used. The supply of direct current is obtained from a number of sub-stations placed along the line, which convert to direct current from a 3-phase overhead transmission system at 88,000 V. The total length of the Glencoe-Pietermaritzburg section of the railways to be electrically equipped is 171 miles, and of this the electrification of over 100 miles is now completed.

Trade Announcements.—MESSRS. C. W. BURKILL & Co., wireless engineers, Station Road, Castleford, have opened a new branch business at 2, Albion Street, in that town.

MR. JOSEPH SHAW, electrical engineer, has opened new showroom premises at Stamford Street, Ashton-under-Lyne.

MESSRS. L. MCMICHAEL have now become installed in their new works and offices at Wexham Road, Slough. Their telephone Nos. are: "Slough 441 and 442," and their telegraphic and cable address is "Radiether, Slough."

The FOSTER ENGINEERING CO., LTD., has opened a new branch at 140b, Victoria Street, Bristol, with Mr. W. J. Murphy as manager.

Catalogues and Lists.—MESSRS. WARD & GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester.—Radio catalogue No. 113, containing illustrations and prices of complete sets, components, and accessories. Also an illustrated pamphlet dealing with the "Goltone" 8-valve super-heterodyne receiver.

MESSRS. A. REYROLLE & Co., LTD., Hebburn-on-Tyne.—Brochure No. 521/9-25, containing fully-illustrated details of the "Pebbles-Reyrolle" automatic motor-converter sub-station equipment.

MESSRS. L. G. HAWKINS & Co., LTD., 30-35, Drury Lane, W.C.2.—A folder advertising the "Millerette" totally-enclosed lighting unit.

THE POWER EQUIPMENT CO., LTD., Kingsbury Works, The Hyde, Hendon, N.W.9.—Illustrated pamphlets describing "Powquip" radio transformers and coils.

MESSRS. SIEMENS BROS. & Co., LTD., Woolwich, S.E.18.—Pamphlet 820A, illustrating and describing the company's thermo-electric pyrometers for use up to 1,400 deg. C.

THE MIDLAND ELECTRIC MANUFACTURING CO., LTD., Barford Street, Birmingham.—An illustrated and priced catalogue of the company's ironclad switch- and fuse-gear.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—A comprehensive illustrated catalogue of radio apparatus of many makes, and separate pamphlets dealing with "Marconiphone" variometers, receivers, and amplifiers.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Leaflet No. O.S. 3406, containing illustrations and prices of "Osram" colour-sprayed gasfilled lamps.

PHILIPS LAMPS, LTD., 60, Wilson Street, Finsbury Square, E.C.2.—A booklet entitled "Light on Lamps," describing the production of "Philips" lamps.

MESSRS. JAMES GORDON & Co., LTD., Windsor House, Kingsway, W.C.2.—Catalogue "H," describing complete plant for the development of water power, including turbines, Pelton wheels, governors and pipe lines. A great deal of hydro-electric data is embodied in the publication.

VENNER TIME SWITCHES, LTD., 45, Horseferry Road, S.W.1.—List No. 26, describing the "Venner" stop watch for use in testing.

PYREX ENGINEERING CO., Adelaide Buildings, Docks, Cardiff.—Two illustrated booklets dealing respectively with "Mema" electric drilling machines and "Wex" a.c. welders and rivet heaters.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—Pamphlet Wa401, showing the amplification ratio of the "Ferranti" intervalve transformer, type "A.F.3," throughout the whole of the musical scale, and explaining the correct use of the component.

KLAXON, LTD., 36, Blandford Street, Marylebone, W.1.—A booklet describing examples of "Klaxon" apparatus for factories, mines, and other industrial purposes.

THE MICA MANUFACTURING CO., LTD., Volta Works, Bromley, S.E.—A price list of various classes and quantities of mica which the company has for disposal.

HERBERT MORRIS, LTD., Loughborough.—A folder advertising "Morris" electric hoist blocks.

STANDARD TELEPHONES AND CABLES, LTD. (formerly Western Electric Co., Ltd.), Connaught House, Aldwych, W.C.2.—A handsome coloured showcard advertising the "Kone" loudspeaker.

MR. W. J. GORRILL, 40, Bromar Road, Camberwell, S.E.5.—A price list of wiring materials and accessories, including some radio apparatus.

Bankruptcy Proceedings.—W. K. COXON and E. R. WEARE, trading as the Western Manufacturing Co., Nurshill, Lydney, Glos., radio apparatus manufacturers.—The first meeting of creditors was held on November 4th at 34, Park Place, Cardiff. The statement of affairs showed ranking liabilities of £2,028, against net assets of £1,427, leaving a deficiency of £601. Debtors attributed their failure to over-advertising, over-purchasing, and the slump in trade. The matter was left in the hands of the Official Receiver (Mr. Ellis Owen) as trustee of the estate.

J. WILSON, electrical engineer, 70, Ebrington Street, Plymouth.—Receiving order made October 30th on debtor's own petition.

C. W. A. ASHWORTH, electrical engineer, West Street, Oundle.—First and final dividend of 8½d. in the £ payable at the Official Receiver's office, 5, Petty Cury, Cambridge.

V. READ, electrical engineer, 10, Chapel Road, Eastville, Bristol.—Receiving order made November 4th on creditor's petition.

B. UTTLEY, electrician, Tower Street, Bacup.—First meeting November 13th, at the Official Receiver's offices, Byrom Street, Manchester. Public examination November 27th, at the County Police Court, Rochdale.

W. P. YOUNG (W. P. Young & Co. and Leicester Tanning Machinery Co.), mechanical and electrical engineer, 40 and 42, Sanvey Gate, Leicester.—Application for discharge to be heard on December 3rd at The Castle, Leicester.

P. L. SYMONDS, electrician, 4, Victoria Road, Great Yarmouth.—First and final dividend of 4s. 7½d. in £ payable at the Official Receiver's office, 9, Queen Street Chambers, Norwich.

A. THOMPSON (Arnold Electrical Co.), electrical and mechanical engineer, 38, Lucy Street, Hulme, Manchester.—First and final dividend of 1s. 2½d. in the £ payable November 16th at the Official Receiver's office, Byrom Street, Manchester.

Company Liquidations.—MERCHANTS & AGENCIES, LTD., importers and wholesale dealers in radio apparatus, 38, Great Russell Street, W.C.1, late of Basinghall Street, E.C.—A meeting of creditors was held on November 5th, when an approximate statement of affairs was presented showing the position as at October 16th last, on which date a resolution for voluntary liquidation was passed by the shareholders. The statement disclosed ranking liabilities of £7,825 and net assets of £2,889, leaving a deficiency as regarded the creditors of £4,936. Mr. J. S. B. Hole (Messrs. Oscar Berry & Co.), stated that the company was registered on September 15th, 1923, with a nominal capital of £3,000 in £1 shares. The primary object of the company was to enter into, and carry into effect, an agreement with Mr. H. S. Leben, and at the date of the liquidation Mr. H. S. Leben was the sole director. After allowing for all the expenses the company had carried on business throughout at a net loss of £4,024. The deficiency as regarded the shareholders was £6,984. In answer to a question, Mr. HOLE stated that at the date of the liquidation there were a number of contracts running for the supply of goods, and articles were arriving in London almost daily. The liquidator had been able to take up some small parcels and had arranged for others to be taken up, with the result that the contracts had been continued. At the moment there was only one contingent claim for breach of contract. A resolution was passed in favour of an application being made to the Court for the appointment of Mr. Charles Lathan, of 78, New Oxford Street, W., as liquidator. The following are creditors:—

	£		£
Berliner & Co.	2,725	Inland Revenue	45
Zeiler	2,588	Woolland & Co.	37
Ahemo	664	Youels, Chant & Co.	31
Marleco	426	Lawrence, W. P.	28
Titania	322	Sankey, W. A., & Co.	26
Kurz, E., & Co.	274	Sponholz, Ltd.	23
Cotzin Bros.	250	Leben, Henry	25
Albion Co	148	Leben, Mrs. H. S.	20
Frelat, N. V.	52		

CLEVELAND ELECTRICAL ENGINEERING CO., LTD.—Meeting of creditors November 16th, at 29, Grange Road West, Middlesborough. Liquidator, Mr. M. McGilligan.

ANGLO-POLISH ELECTRICAL DEVELOPMENT CORPORATION, LTD.—A meeting of members is called for December 9th, at 603, Australia House, Strand, W.C., to hear an account of the winding up from the liquidator, Mr. E. N. Humphreys.

METRODES, LTD.—Winding up voluntarily. Liquidator, Mr. J. Henderson, 6, East Parade, Sheffield. A meeting of creditors was called for November 11th. Particulars of claims to the liquidator by November 30th.

TOPSHAM ELECTRICITY SUPPLY CO., LTD.—Meeting of creditors, November 18th, at 23, Catherine Street, Exeter.

SUTHERLANDS (ELECTRICAL ENGINEERS), LTD.—A meeting of members is called for December 10th at 20, Acresfield, Bolton, to hear an account of the winding up from the liquidators, Mr. A. Greenhalgh and Mr. J. O. Young.

NEW ROTTINGDEAN ELECTRICITY CO., LTD.—A meeting of members is called for December 12th, at Union Bank Chambers, 8, North Street, Brighton, to hear an account of the winding up from the liquidator, Mr. H. B. C. Baldwin.

Dissolution of Partnership.—HUNTER, OGLE & Co., electrical engineers and manufacturers' agents, 174, Corporation Street, Birmingham.—Mr. T. H. Hunter and Mr. J. G. Ogle have dissolved partnership. Mr. Ogle will attend to debts and continue the business under the same style.

Swiss Financing of Foreign Undertakings.—The directors of the Bank for Electrical Undertakings of Zurich, in the course of their annual report for 1924-25, state that a circumstance which still suggests the adoption of increased caution, especially in connection with the financing of electrical undertakings in other countries, lies in the constant tendency of State and municipal authorities to consider the supply of electricity as if it were a public benevolent institution, thus causing electricity producing and distributing companies the greatest difficulty in the fixing of sufficiently high tariffs. Among the numerous transactions submitted to examination in the past year the bank restricted itself chiefly to further participation in Austrian electricity companies. Further satisfactory results attended the efforts to combine financial operations abroad with contracts for the delivery of plant to be allotted to Swiss firms.

New French Company.—La Société des Véhicules et Tracteurs Electriques (Vetra) has lately been formed in Paris (186, Rue du Faubourg St. Honoré) with a capital of 300,000 fr., to manufacture electric vehicles and tractors.

Belgian Congo Company.—A new company is in course of formation in Brussels with a capital of 75 million francs and the title La Société Générale des Forces Hydro-Electriques de Katanga, to develop the water power resources of the Belgian Congo.

Removal of Foreign Loan Embargo.—In the course of a speech at Sheffield last week, the Chancellor of the Exchequer stated that the Government intended to remove forthwith the embargo upon the flotation of Dominion and foreign loans in the London money market. It is generally considered that the removal of the embargo will have a beneficial effect upon British trade and industry. In an interview with the *Financial News*, Mr. R. T. Nugent, director of the Federation of British Industries, said that the Federation was delighted to see the removal of the embargo. "An increase in foreign investment will inevitably result sooner or later in the export of British goods. The lifting of the embargo marks the final step in the return to more normal conditions, removing as it does the last artificial barrier to a free gold market." Asked if he considered that we should have waited until the import season was over, Mr. Nugent replied that he did not expect any immediate rush for loans, and that he did not consider the removal premature. He emphasised the fact that all foreign investments must help our export industries—some more quickly than others. In any case, the ultimate effect would be beneficial to all our industries. There were grounds for anticipating a marked improvement in trade within the next twelve months—not a boom—but a steady recovery.

Brighter London.—Four 5,000-W Philips lamps, hung on the Holborn Empire, have made the High Holborn district the lightest spot in the Metropolis. Each of the lamps is of 10,000 candle power.

South African Tariff Decision.—The South African Commissioner of Customs has recently ruled that lamps and self-starters imported into the Union attached to motor chassis are not classifiable as parts of the chassis but are dutiable separately under their appropriate tariff items.

Sales to Receivers and Managers.—Suppliers of goods are frequently in doubt as to the execution of orders given by receivers and managers appointed by the debenture-holders of companies. To assist its members the Wireless and Radio Trades Guardian Association has sent them a circular which helps to clarify the situation. It is pointed out that receivers and managers are of two classes—those appointed by the Court and those appointed by the debenture holders themselves. A receiver of the first class is virtually a Court official and cannot be absolved from personal liability for goods ordered under his direction, although in some cases attempts have been made to evade personal responsibility. The second class of receiver is usually the agent of the company and is not personally liable, nor are the creditors for goods entitled to look to the assets in his possession for payment of their accounts, for these assets are the property of the debenture holders. It is considered that in the case of a receiver not appointed by the Court the safest plan is to have all orders signed by him personally and not as receiver and manager, and invoices, &c., should be made out to him personally, or his personal guarantee obtained.

A Battery Calculator.—MESSRS. PRITCHETT & GOLD AND E.P.S. Co., LTD., have produced a handy little device by means of which the type and size of accumulator to order to give required results when made up into 100, 50, or 25-V batteries can be ascertained. It consists of a celluloid slip in a case of the same material. The appropriate sets of figures appear in perforations at the edge of the case when the slide is adjusted.

Book Notices.—"Charles Letts's Engineering Diary, 1926." London: Charles Letts & Co. Price 3s.—This is the fourth publication of this useful and interesting pocket-book, which has been brought up to date with many improvements and additions. Many valuable data are contained therein, including electrical, mechanical, chemical, relating to the distinctions and abbreviations of the professional institutions, &c. The usual mathematical and decimal and metric tables, together with conversion tables, are also included, while much general information, including foreign currency particulars, train and postal rates, &c., adds greatly to the value of the book. It is bound in a neat leather cover.

"Scientific Papers of the Bureau of Standards, No. 510 (Part of Vol 20)."—Effect of Wear on the Magnetic Properties and Tensile Strength of Steel Wire. Price, 5 cents.

"*Journal* and Record of Transactions of the Junior Institution of Engineers." Vol. XXXVI. Part II. November, 1925. Price, 2s.

A Tall Order.—Messrs. Hoover, Ltd., in response to their offer to give a free demonstration with their cleaner to Burnley people, have received a coupon signed by a gentleman in Nigeria. An accompanying letter said:—"I thank you very much in advance. Kindly let me have it with the next coming mail."

German Contract for Harbin.—It is reported from Berlin that the Siemens-Schuckert Works Co. has concluded an agreement with the holders of the tramway concession in Harbin for the delivery of tramway equipment, including motors, cars, rails, and other material, special guarantees having been assumed on both sides for the fulfilment of the agreement. Banks at Harbin have played the part of intermediaries in the transaction, and emphasis is laid upon the fact that the agreement has an exclusively commercial character. The financial side of the matter lies in the hands of the concessionnaires. On the other hand, it is stated that the Japanese Harbin Co. for Electrical Undertakings in North Manchuria has raised objections to the prolongation of the concession for the Harbin tramway and against the allocation of the order without competition.

Irish Free State Electrical Imports.—The official returns just issued show that the imports of electrical goods (excluding machinery) into the Irish Free State during July last, amounted to £23,358, as compared with £27,173 in July, 1924. The figures for the first seven months also show a marked shrinkage in electrical imports—from £244,075 in 1924 to £182,502 this year.

The Italian Cable Industry.—An interesting report on the production and sale of insulated wire and cable in Italy has been furnished to the French Government by its Commercial Attaché. The Italian manufacture of insulated wire and cable had its origin in Milan in 1879, the year in which the house of Pirelli established in that city a small factory of modest proportions. For many years the history of the industry was merely the story of the progress of this works and the branch establishment created in 1886 for the production of submarine telephone and telegraph cables. At the present time there are seven installations of this kind in Italy; two being situated at Milan, and one each at Turin, Genoa, Spezia, Leghorn and Naples. The industry has advanced greatly in importance during the past 20 years. Although it employs a total of not more than 5,000 workpeople, it is one of the most important manufacturing industries in the country, and is in a position to cover practically all the requirements of home consumers and also to carry on a considerable export trade. This latter branch of activity is the more remarkable, inasmuch as the greater part of the raw material employed in the industry must be imported. Practically all descriptions of wires and cables are produced from flexible cords up to high-pressure power cables and submarine telegraph and telephone lines. Whilst in recent years exports have been maintained at a high level imports are only about half as large as they were before the war; figures in quintals being as follows:—Exports: 1914, 33,727; 1920, 44,929; 1921, 20,392; 1922, 11,149; 1923, 25,112; 1924, 24,279. Imports: 1914, 8,375; 1920, 617; 1921, 2,428; 1922, 2,814; 1923, 891; 1924, 4,760. Insulated wire and flexible cord of Italian manufacture are exported to practically every country in Europe, whilst cables find their most important markets in South America, notably Argentina, Uruguay, and Brazil. Nearly all Italy's imports of these classes come from Great Britain.

Belgian Import Requirements.—The *Board of Trade Journal* states that in consequence of the conclusion of a commercial agreement between Germany and Belgium, the list of goods in respect of which certificates of origin are required in order to obtain "minimum" tariff treatment on importation into Belgium has been considerably reduced. The published list, however, shows that many classes of electrical goods are still subject to the requirement.

United States Electrical Exports.—According to *Commerce Reports* exports of electrical machinery and equipment from the United States during August were valued at $8,074,352—an increase of $885,982 over the corresponding month of 1924, being the highest total reached in any month since May, 1921. As compared with the same month of 1924 there was a considerable decrease in shipments of power-generating and distributing equipment during August, except in the cases of power transformers, which were practically doubled, and switchboards and switchgear, in which there was a large increase. The rises in these items more than counterbalanced the losses in generating plant. Motors of all classes, together with equipment and accessories, showed a satisfactory increase, especially in the case of railway motors, the value of which rose from $24,634 in August, 1924, to $192,211 in August, 1925. In the latter month no electric railway locomotives were exported. In the case of domestic electrical appliances, an all-round increase of small dimensions occurred, although there was a decrease in the exports of house-wiring material. Radio apparatus again showed a very large increase, the figure rising from $541,238 to $844,379—an increase which more than offset the decreases in other communication equipment. Batteries also showed a remarkable rise, no doubt consequent upon the increase in exports of radio apparatus. Industrial and electric furnaces and ovens, carbon products, flash lights and therapeutic apparatus, all showed satisfactory increases in quantity and value. Decreases included telephone and telegraph equipment, signalling apparatus, and insulating material.

Unemployment.—The registers of the Employment Exchanges for the week ended October 26th showed a fall of 5,758 in the number of unemployed, the total at that date being 1,232,400.

The Tientsin Electrical Market.—In a recent article upon the growth of the electrical undertaking of the British Municipal Council at Tientsin, the *Peking and Tientsin Times* gave several indications of openings for electrical apparatus. It was stated that refrigerators were likely to be in great demand shortly, but only American firms were taking advantage of the opportunity. Cooking appliances, especially those adapted to the preparation of rice, were becoming popular, and electro-medical apparatus for personal use had a large sale in the Far East. The demand for washing machines (from American sources) threatened to exceed the supply. The article complained that British manufacturers did not seem to realise the potential market which the Far East offered with regard to what was "obviously going to provide big business," although Germans and Americans were constantly pursuing inquiries in furtherance of their chances in so fast-growing a trade.

For Sale.—Edinburgh Corporation electricity supply department invites offers for 20 tons of clean scrap copper wire. (See our advertisement pages to-day.)

American Mine Locomotives for Russia.—It is reported from New York that the Westinghouse Electric International Company announces that the Amtorg, which represents the Soviet Government, has placed an order for the delivery of 25 electric locomotives for use in connection with the electrification of the Donetz coal mines. This is the first order of the kind which has been allotted to the United States.

The German Cable Industry.—According to a report issued at the end of last month, the German cable manufacturing industry shows signs of becoming worse. This is attributed to the lack of private orders, particularly from abroad. As is known, the contracts placed by the postal and telegraph administration represent the most important orders for the industry, but as the latter possesses plant in excess of that necessary to execute the orders given by the State departments, it depends to a large extent upon private orders. These have been practically lacking for some time past, and the cable factories have therefore executed the State orders quickly with the object of avoiding an increase in the costs of production which would have resulted from running at "part load." It thus happens that the State orders, which at the beginning of the financial year are allotted to the cable factories in accordance with the Budget estimates, are now being delivered, although, under the contracts, they are not due for delivery for some three to six months. The post and telegraph authorities, however, are unable to pay for the cables before the pre-determined time, to say nothing of placing fresh orders for the year 1926-27. Proposals which were recently made in this direction by the cable manufacturing interests to the ministries concerned met with a negative reply, although the official departments know that difficulties will consequently arise for the cable industry, which will lead to dismissals of workmen. In this connection it is mentioned that restrictions in the number of workmen have already taken place at the works of the Felten & Guilleaume Company, of Cologne-Mulheim, although this company is probably one of the best occupied owing to the manufacture of the Azores submarine cable. The other cable factories will also presumably have to have recourse to discharges, as the working capital is tied up in the orders executed for the State and not yet paid for, and further working for stock is out of the question in consequence of the scarcity of capital, as was, for instance, referred to in the recent annual report of the Rheydt Cable Co. These difficulties are not individual, but apply to the cable industry without exception. Nevertheless, the hope is still entertained that the negotiations with the authorities for premature payment for the deliveries may yet lead to the adoption of an accommodating attitude so that the discharge of workmen will be avoided.

Suspension of Nicaraguan Import Duty.—The Nicaraguan Government has recently suspended the import duty on dynamos, generators, motors, and similar machinery.

Lighting and Power Notes.

Ashton-under-Lyne.—NEW ELECTRICITY CHARGE.—With a view to encouraging the greater use of electricity by householders the Corporation Electricity Department is to sell electricity on the basis of 15 per cent. on the assessment of the house, plus ½d. per kWh against the existing price of 5d. per kWh. It is hoped later to extend the scheme to houses attached to business premises.

Audenshaw.—STREET LIGHTING.—The Urban District Council is to approach the Manchester Corporation with a view to obtaining a quotation for lighting the main thoroughfares by electricity.

Australia.—COLLIE (W.A.).—According to the *Electrical Engineer of Australia and New Zealand*, a deputation which waited on the Premier of Western Australia recently urged the erection of a power station on the Collie coalfield to supply energy to Collie, Bunbury and the intermediate districts. The scheme is estimated to cost £216,650, and such a station would form the nucleus of a plant that might be expanded to 150,000 kW capacity as the demand arose. The Government is being asked to contribute half the cost.

WESTERN AUSTRALIA.—The accounts of the Government electricity undertaking for the year ended June 30th last show a total income of £185,190, as compared with £166,210 in 1923-24. Operating expenses increased from £116,150 to £133,805, and there was a gross profit of £51,385 (£50,058). After providing for capital and other charges there was a net deficit of £2,125, as compared with a surplus of £430 in the preceding year. The sales of electrical energy increased from 39,100,707 to 44,112,802 kWh, and the maximum supply demanded from 11,500 to 12,400 kW. Contracts were placed during the year for a 12,500-kW turbo-alternator and two 65,000-lb. boilers. These additions, together with other extensions, will, it is estimated, cost £239,950.

Barking Town.—ELECTRICITY IN BULK.—The Urban District Council has come to an agreement with the County of London Electric Supply Co., Ltd., for a temporary bulk supply at the rate of 9s. 2d. per month per kW of maximum demand, plus ¼ per kWh, the terms to be operative until such time as the main bulk supply is available.

Bethesda.—ELECTRICITY SUPPLY.—The Urban District Council has obtained an Order authorising it to supply electricity in the district. The maximum charges are:—Summer months: Up to 10 kWh, 7s. 6d.; all energy in excess of this amount 9d. per kWh. Winter months: Up to 15 kWh, 11s. 3d.; all energy above this amount 9d. per kWh.

Burnham (Essex).—ELECTRICITY SCHEME.—The Urban District Council has accepted the offer of Mr. Purves to carry out an electric lighting scheme for the district.

Continental.—GERMANY.—It is reported that work is about to be commenced on the construction of two new hydro-electric stations to utilise the water power of the Rhine at Niederschwörstadt and Rekingen respectively. The current will be utilised for traction purposes on the Baden State railways.

CZECHO-SLOVAKIA.—According to a recent Government report, there were 385 electric power stations in operation in Czecho-Slovakia at the end of 1924, the total installed capacity being 290,182 kW. The average annual consumption of electricity per head of population was 31.8 kWh, but the completion of the Rechenberg distribution system, which extends over a wide area, is expected to raise this to 180 kWh in the near future.

FRANCE.—According to the recently-issued annual report of the Société de l'Union d'Electricité, of Paris, the sixteenth turbo-generator (40,000 kW) is now in operation at the Gennevilliers power station, and work is in hand on the installation of the seventeenth and eighteenth sets, which, when completed, will bring the capacity of the station up to 340,000 kW. In addition, the Vitry station of the company has an output of 90,000 kW. As a result of these extensions it has been found possible to close down the old station at Asnieres, near Paris; that at Puteaux is, however, being retained for the present as an emergency plant for power supply in the winter months.

BELGIUM.—The Société Intercommunale Belge d'Electricité, in its report for the year ended June 30th last, states that, in view of the increasing demand for electricity, it is arranging for further plant extensions. A new 8,200-kVA turbo-generator is being installed at its Paturages power station, one of 15,500-kVA capacity is being erected at the Malines station, a fourth set of 11,500 kVA has been ordered for the Alost station, and a fourth set for the Bressoux station.

Deal.—ELECTRICITY IN BULK.—The Deal and Walmer Gas Co. is negotiating with the Dover Corporation for a bulk supply of electricity.

Doncaster.—ELECTRICITY SUPPLY.—The Corporation is supplying electricity to householders in Bentley at a flat rate of 1s. per week.

Earby (Yorks.).—ELECTRICITY SCHEME.—The Urban District Council is canvassing residents to ascertain the number who would be willing to take an electricity supply. The charge for lighting is not expected to exceed 7d. per kWh and to small consumers of power it is expected to be 2½d. to 3d. per kWh.

At a recent meeting of the Colne Town Council, the engineer submitted draft terms for the supply of electricity in bulk to Earby and these were approved.

East Ham.—ELECTRICITY AGREEMENT.—At a recent meeting of the Electricity Committee the engineer reported that the West Ham Corporation was willing to lay at its own cost a new feeder cable from its works to the East Ham generating station, subject to the amount of the maximum demand set forth in the agreement being increased, and that, in accordance with clause 12 of the agreement, he had notified the West Ham Corporation that the maximum demand will be increased from 600 to 1,500 kW in respect of the current year.

Harpenden.—PRICE REDUCTIONS.—The North Metropolitan Electric Power Supply Co. has reduced the charges for electricity for lighting on the flat rate from 7d. to 6d. per kWh; on the maximum demand rate from 10d. and 2d. to 10d. and 1½d per kWh; for heating from 2½d. to 2d. per kWh; on the annual service rate the meter rent of 2s. 6d. per quarter is abolished.

Ilford.—LOAN.—The Electricity Committee is applying for sanction to a further loan of £2,000 for the purchase of domestic apparatus to be let out on hire.

Irish Free State.—KINGSTOWN (CO. DUBLIN).—The Urban District Council has entered into an agreement with the Blackrock Urban District Council whereby Kingstown will supply electricity in a specified area of the Blackrock urban district. It is provided that the cost of electricity to consumers in the Blackrock district shall not exceed the charge made to residents of Kingstown.

Japan.—HYDRO-ELECTRIC DEVELOPMENT.—It is reported that the Daido Denryoku Kaisha has decided to establish the Shokawa Hydro-Electric Co. with a capital of 30,000,000 yen. Two power stations, each with a capacity of 38,000 kW, are to be erected on the Shokawa river.

Kendal.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £4,000 for extensions of plant and buildings.

ELECTRICITY IN BULK.—The promoters of a manufacturing company who propose establishing works in the town and installing electrical plant, have inquired whether the Corporation would be disposed to take a bulk supply of electricity from the company.

London.—HACKNEY.—*Year's Working.*—We have received from Mr. L. L. Robinson, borough electrical engineer, a copy of his report together with the statement of accounts on the working of the electricity undertaking for the year ended March 31st last. The total revenue amounted to £177,275, and the working expenditure was £87,125, leaving a gross surplus of £90,150. The corresponding figures for the preceding year were £176,903, £83,453, and £93,450 respectively. To the gross surplus was added interest on investments and profit from the sale of funding loan stock, making a total of £95,000 available. Capital and other charges absorbed £68,732, and there was a net surplus of £26,268, which with a surplus of £342 on the Sales Department, was transferred to appropriation account. This was disposed of as follows:—Capital expenditure defrayed from revenue, £15,898, borough fund, £10,712. The previous year's working resulted in a net profit of £30,798. The amount spent on capital account during the year was £75,989, the largest items being £21,637 for machinery and plant, and £24,457 for mains and services. The sales of energy increased from 22,199,398 to 24,763,274 kWh, and the average price obtained fell from 1.83d. to 1.64d. per kWh. The maximum supply demanded rose from 12,200 to 13,439 kW.

HAMPSTEAD.—The Borough Council is to expend an additional £3,000 on "free wiring" during the current year, making a total of £6,000 in all. Mr. J. Leadbeater, the borough electrical engineer, informs us that as the result of the introduction of this scheme 1,000 new consumers have been added to the system.

New Zealand.—DUNEDIN.—The accounts of the City Council's electricity undertaking (engineer, Mr. M. C. Henderson) for the year ended March 31st last, show a total revenue of £130,186, as compared with £120,886 in the preceding year. Working expenses amounted to £47,328, as against £46,346, leaving a gross profit of £82,858 (£74,541). After deducting capital charges there was a net surplus of £20,888, as compared with £17,636 in 1923-24. A total of 23,120,680 kWh was sold, as against 21,701,942 kWh in the preceding year, and the connections increased from 26,698 to 29,463 kW. A 5,500-h.p. turbine coupled to a 3,000 kW alternator was put into service during the year, and work on the installation of a 3,000-kW set was commenced. When this is completed the station will have a capacity of 11,000 kW.

Portsmouth.—LOAN.—The Town Council is applying for sanction to the borrowing of £35,000 for mains.

Preston.—EXTENSION OF SUPPLY.—The electricity supply from Preston to Leyland was recently formally inaugurated by the chairman of the Electricity Committee. The industrial load already contracted for in Leyland includes 1,200 kW to one undertaking, and negotiations are proceeding with other concerns.

Sheffield.—ELECTRICITY EXTENSIONS.—The Electric Supply Committee has approved extensions of mains and works, at an estimated cost of £5,105, and extensions of mains for general distribution purposes costing £12,475.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them amending the Pontypool Electric Lighting Order, 1895, granted to the Pontypool Electric Light and Power Co., Ltd., and suspending the power of the local authority to purchase the undertaking authorised by that Order.

Application has been made to the Commissioners by the Whitchurch (Salop) Gas Co., Ltd., for an Order authorising it to supply electricity in the urban and rural districts of Whitchurch and the rural district of Malpas.

Torquay.—ELECTRICITY SUPPLY.—At a recent meeting of the Electricity Committee the engineer reported that in order to provide for the increasing use of electricity in the Newton Abbot district, further provision would have to be made in the power station, either in the form of an additional rotary converter or by the installation of transformers to convert a portion of the Newton Abbot distributing network from d.c. to a.c. He recommended the latter scheme, and the Committee instructed him to proceed with the work subject to his submitting estimates of the cost in due course, with a view to application being made for sanction to the necessary loan.

LOANS SANCTIONED.—The Electricity Commissioners have given their sanction to loans of £1,700 for mains and £1,950 for plant in connection with the supply to Stoneycombe Quarry.

United States.—ELECTRICAL DEVELOPMENT.—The *Financial Times* states that plans have been completed for the financing and carrying out of a hydro-electric scheme in the heart of the Ozark Mountains in Missouri. The project will be one of the largest in America. The recently-formed Missouri Hydro-Electric Company will undertake the work, which calls for harnessing the Osage River and tributaries and for the construction of several large lakes, one of which will be the largest artificial lake in the world, having a shore line of 260 miles. The cost of the scheme is estimated at $50,000,000.

According to *Power*, work is to commence immediately on the installation of additional plant at the Long Beach steam power station of the Southern California Edison Co. The additions will comprise a G.E.C. single-cylinder-type turbine rated at 50,000 kW, 50 cycles, 3 phase, 11,000 V, seven 375-lb. Stirling-type Connelly boilers, and Westinghouse condensers. The estimated cost of the additions is $6,000,000, and it is expected that the work will be completed by July, 1926.

Winchester.—YEAR'S WORKING.—The accounts of the city electricity undertaking (engineer: Mr. R. Ayton) for the year ended March 31st last record a total income of £32,989, as compared with £31,971 in the preceding year. Working expenses amounted to £21,678, as against £19,680, leaving a gross profit of £11,311 (£12,291), to which was added bank interest, making a total of £11,472 available. After providing for capital and other charges, a net surplus of £2,212 remained, as compared with £2,781 in 1923-24. The energy sold increased from 1,950,208 to 2,009,986 kWh.

Tramway and Railway Notes.

Australia.—NEW SOUTH WALES.—According to the *Industrial Australian and Mining Standard*, after meeting interest charges amounting to £5,343,318, there was a total deficiency of £69,142 on the transactions of the New South Wales railways and tramways for the year ended June 30th last. The deficiency was made up as follows:—Railways, surplus, £32,937; tramways, deficiency, £102,079. The report of the Commissioners states that the net earnings were adversely affected by further reductions in freight rates during the year, increases in wages and salaries, and also by previous reductions in rates and fares. The report adds that the railway and tramway earnings amounted to £20,388,724, and working expenses to £15,114,548, leaving a balance of £5,274,176, which had been paid into consolidated revenue to meet interest charges. During the year 132 miles of new lines were added, and the total mileage now open for traffic is 5,655. As in the preceding report, special attention is drawn to the non-paying lines, on which there was a loss, after paying interest charges (amounting to £1,611,798), of £1,505,010. There were 55 of these lines, totalling 3,586 miles (more than 63 per cent. of the whole of the State's mileage), on which the capital expended was £32,015,994.

Barbados.—TRAMWAY SERVICE DISCONTINUED.—The Bridgetown Tramways Co. has discontinued its service. The company has not been able to meet the increased competition from motor-omnibuses during the past three years, and its traffic has steadily declined.—*Commerce Reports.*

China.—ELECTRIFICATION SCHEME POSTPONED.—It is reported that the scheme for the electrification of the Fushun line of the South Manchurian Railway has been postponed temporarily under the existing retrenchment policy, as the realisation of the scheme is estimated to cost 2,500,000 yen.

Continental.—SWEDEN.—Good progress is being made with the electrification of the railway between Stockholm and Gothenburg. Of the 50 electric locomotives ordered, 28 have already been delivered, and nine more will be completed in a few weeks. It is expected that the Hallsberg-Falkoeping section will be opened for goods traffic during the present month; passenger traffic will not begin until next year. The electrification of the whole line will probably be completed by May next year.—*Reuter's Trade Service* (Stockholm).

SWITZERLAND.—Rapid progress is being made with the electrification of the Geneva-Lausanne section of the Swiss Federal Railways, and it is expected that the line will be completed for electrical operation by the commencement of the new year.

AUSTRIA.—The hydro-electric power station on Lake Spuller, which has been established by the Austrian State Railway authorities to supply part of the power required for the electrified Arlberg railway, has recently been completed and put in operation, the plant so far installed having a maximum capacity of 24,000 h.p. The Arlberg line between Innsbruck and Bludenz is now entirely run by electricity, and it is estimated that, in conjunction with the electrification of the Salzkammergut railway, not only will higher speed and lower maintenance costs be possible, but that there will be an economy in coal consumption of 130,000 tons per year.

Japan.—NEW ELECTRIC RAILWAYS.—Applications for licences from five promoters of schemes for new electric railways were recently laid before the Osaka Municipal Council. The proposed railways will serve the suburbs of Osaka and link up with the towns of Kyoto, Nara, Kobe, and Amagasaki.

India.—CALCUTTA.—A big scheme for the general reorganisation of the Calcutta tramway service, involving the lay-out of circular routes, a revision of the present fares and the adoption of a new system of regulating fares by stages, has been under the consideration of the Calcutta Tramways Co., Ltd., for some time past. Plans have now been completed for carrying out the proposed alterations, and it is expected that within a few months the remodelled service will be inaugurated.—*Indian Engineering.*

Leeds.—NEW ROUTE.—It was reported at a recent meeting of the Tramways Committee that the new tramway to Middleton is nearly complete, and is expected to be available for service before the end of November.

DEPOT EXTENSION.—The Committee has decided to enlarge the central tramway depôt in Swinegate. The present accommodation is for 55 cars, and it is proposed to extend it to accommodate 200 cars.

Liverpool.—PURCHASE OF UNDERTAKINGS.—A special meeting of the City Council has been called for December 2nd to consider a proposal to acquire from the Urban District Councils of Waterloo-with-Seaforth and Great Crosby their respective

tramway undertakings, authorised by the Waterloo-with-Seaforth Tramways Order, 1898, and the Great Crosby Tramways Order, 1898. The Council will be asked to apply for the sanction of the Minister of Transport to the scheme.

London.—TRAMWAY IMPROVEMENTS.—The Highways Committee of the London County Council has recommended the construction of a tramway junction line at Catford and Bromley Roads to provide a direct service between Downham and Central London, *via* Catford, Forest Hill, and Dulwich, when the tramway extension to Downham is completed. The estimated cost of the scheme is £5,500.

New Zealand.—DUNEDIN.—The report of the manager of the city tramway undertaking (Mr. W. H. Mackenzie) for the year ended March 31st last shows a total revenue of £129,714, and working expenditure of £85,170, leaving a gross profit of £44,544. The figures for the preceding year were: Income, £126,407; working expenses, £85,906; gross profit, £40,501. After deducting capital charges, a net profit of £9,511 remained, as compared with £6,830 in the preceding year. The number of passengers carried increased from 19,482,997 to 19,729,585, and the car-miles run from 1,536,573 to 1,546,910.

Southern Railway Electrification.—The Southern Railway has issued a report stating that the suburban electrification scheme—from Charing Cross and Cannon Street to Orpington, *via* Chislehurst, Bromley North, Elmers End, and Addiscombe—scheduled for December 1st next, has had to be postponed for at least two months. This is due to the fact that the electricity supply contractors have informed the company that it is not possible for them to have the necessary supply ready by December 1st.

United States.—NEW ELECTRIC RAILWAY.—Surveys have been made by the Pacific Electric Railway for a line to be constructed between San Bernardino and Lake Arrowhead, Cal. If the line is built it will be under a joint arrangement between the Lake Arrowhead Company and the Pacific Electric Railway and operated by the latter company.—*Electric Traction.*

Telegraph and Telephone Notes.

Automatic Telephony.—LEEDS.—The change-over to automatic telephone services at the suburban district exchanges at Stanningley, Roundhay, Chapeltown, and Headingley took place on November 7th. This is an extension of the automatic system which has been in operation at the Leeds central exchange for some considerable time, and its extension to the suburbs gives Leeds the largest automatic telephone exchange in the country. The extension to these suburban stations adds upwards of 4,000 lines to the 7,000 already on the dial system. Curiously enough, Leeds, signally favoured in telephone service in this direction, is considerably later than most towns of West Yorkshire in adopting the street telephone kiosk, the first having only just been provided at Roundhay. The kiosks are provided by the Post Office on application by the local authorities. Morley, Rothwell, Crossgates, and Horsforth sub-exchanges are still on the old system, and their change-over is not at present contemplated.

Belgium.—TELEPHONE SERVICE.—According to a recent report, there are now 347 telephone exchanges in operation in Belgium, with a total of 105,026 subscribers. Brussels has six exchanges, three of which are automatically worked; the other three are being converted to automatic operation, and the work is expected to be completed by the end of the year.

CABLE DEVELOPMENT.—The first tenders for the supply of the new telephone and telegraph cables from Brussels to Herbesthal and from the French frontier to the Dutch frontier were submitted on November 4th. A Belgian company made the lowest quotation for the first contract, while for the second, third, and fourth contracts German firms offered the lowest terms.—*Reuter* (Brussels).

Colombia.—TELEPHONE SERVICE.—Evidence of the growing use of the telephone in the South American Republic of Colombia is afforded by the fact that no less than 90 small towns in the Department of Boyaca are now provided with exchanges.

Hull. TELEPHONE TARIFF.—The Corporation Telephone Committee has instructed the manager to report on the question of reducing the telephone charges.

Telegraphists' Strike.—SETTLEMENT REACHED.—At a meeting of the Association of Wireless and Cable Telegraphists in London on November 4th, it was officially announced that a settlement had been reached in the dispute with Marconi's Co., and that the nine dismissed men and the operatives on strike would resume duty forthwith.

Radio Notes.

Anniversaries.—CANADA.—The Moncton, New Brunswick (CNRA) station celebrated its first anniversary by broadcasting a special programme to this country on the night of November 6th-7th. The wave-length was 291 metres and the power 750 watts. The station, one of the ten owned by the Canadian National Railways, is 3,300 miles from London.

LONDON.—November 14th being the third birthday of the British Broadcasting Co., Ltd., the event was celebrated this week.

Empire Broadcasting.—A NEW SCHEME.—Major Gladstone Murray, of the British Broadcasting Co., in a lecture at the Overseas Club, is reported by *The Times* to have said it was important that there should be an early adoption of some general scheme which would enable programmes to be exchanged regularly and re-broadcast across all parts of the British Empire. He regarded 5XX (Daventry) as the first link in a new Empire chain. Under existing conditions for British programmes to be re-broadcast in Canada, New Zealand, and Australia it was necessary for them to go through the United States, but in a real Empire chain they would be transmitted from 5XX to a listening post in the Maritime Provinces of Canada (say, in Newfoundland), whence they would be carried by land-line and wireless link to Winnipeg, and there be radiated by a central Canadian high-power station. These signals would be collected again by a British Pacific high-power station in British Columbia, which would reach New Zealand and Australia. Another high-power station in Australia would enable the messages to go forward to the Straits Settlements and thence be relayed from Rangoon to Colombo, in Ceylon, and India.

Irish Free State.—DUBLIN BROADCASTING STATION.—The first broadcasting station in the Irish Free State has been erected by Marconi's Wireless Telegraph Co., Ltd., in the McKee Barracks on the outskirts of Dublin. The studio will be in Denmark Street, off Henry Street. The transmitter, which will operate on a wave-length of 390 metres and will use the call sign 2 RN, is a 6-kW type Q set, the same type as the majority at the British main stations. It is expected that tests will begin shortly, and that the service will be inaugurated during December.

South Africa.—LICENCES.—Owing to the non-payment of licence fees, the three broadcasting stations in the Union are said to be in financial straits, and the Government is being pressed to introduce legislation to make the payment of fees compulsory.

Switzerland.—RADIO LABORATORY.—With the object of enabling manufacturers and importers of radio sets and components to offer their goods for sale in Switzerland with a Swiss certificate of merit, the Jean Noelting Wireless Testing Laboratory has recently been established at Meilen, Switzerland, under the patronage of the Swiss Radio Club.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia. — MELBOURNE. — December 15th. Postmaster-General's Department. Junction apparatus for manual exchanges.*

December 29th. Magnet and resistance wire.*

SYDNEY.—February 1st. Municipal Council. Bunnerong power house equipment. Six 25,000-kW turbo-alternators, 18 100,000 lb. per hour boilers, &c., and 33,000-V switchgear. (See this issue.)

Barking.—January 1st. County of London Electric Supply Co., Ltd. Water-tube boilers with mechanical stokers or powdered fuel equipment, steam turbo-alternators, condensing plant, and auxiliary apparatus for the Barking power station. (October 30th.)

Belgium.—BRUSSELS.—November 25th. Belgian Post and Telegraph authorities. Telephone cables for Tamise, Malines, Willebroeck, and Gheel. Particulars (Cahier des Charges Special No. 3-158) for 6½ fr.

Birkenshaw (Yorkshire).—November 17th. Installation of electric light in 22 houses in the District Council's housing estate at Old Lane. Mr. Ralph Brooks, Council Offices.

Bridlington.—December 7th. Electricity Department. One oil engine, direct coupled to a 275-kW d.c. generator, fuel storage tank, cooling tower, pipework, and pumps. (See this issue.)

Carlisle.—November 19th. Electricity Department. L.p. cast-iron piping for condensing water system. (October 30th.)

Dublin.—December 10th. Great Southern Railways Co. Stores for six months, including electric lamps, &c. Stores Superintendent, Inchicore, Dublin.

Dundee.—Town Council. Electric lighting installation at huts, King's Cross Hospital. Schedules from Mr. G. Baxter, city engineer.

November 20th. Electricity Department. Two-core and three-core l.p. cable. (See this issue.)

Egypt.—December 30th. Inspecting Engineer in London. Queen Anne's Chambers, S.W. Telegraph and telephone material and motor generator and telegraph apparatus.—*Reuter's Trade Service* (Cairo).

ALEXANDRIA.—December 10th. Ministry of the Interior. Machinery in connection with the waterworks scheme at Mellawi, consisting of electric motors and centrifugal pumps, control panels, l.p. armoured cable, &c. (C.X. 1,796.)*

India.—DELHI.—November 30th. Indian Stores Department. Sub-station equipment for Jaipur (comprising insulators, wire, l.p. cable, switchgear, transformer, &c.).*

Kingston-upon-Hull.—November 16th. Electricity Department. Two natural draught cooling towers. (October 30th.)

London.—LONDON COUNTY COUNCIL.—November 16th. Reconstruction of electrical switchgear at Shoreditch sub-station. (October 30th.)

METROPOLITAN ASYLUMS BOARD. December 2nd. Renewal of electric cables, &c., at the Brook (Fever) Hospital, Shooters Hill, Woolwich, S.E.

Madagascar.—January 1st, 1926. Administrateur-Maire, Diego-Suarez, Madagascar. Establishment of a central power station and electricity distribution system for public and private lighting and power purposes in the district. Particulars from the Agence Economique de Madagascar, 40, Rue de General Foy, Paris.

Manchester.—November 23rd. Tramways Committee. Iron and steelwork required at tramcar depôt, Birchfields Road, Fallowfield. Particulars from City Architect, Town Hall.

New Zealand.—WELLINGTON.—December 15th. Post Office Stores Department. Key switches.*

Public Works Department. January 19th, 1926. 50,000- and 110,000-V switchgear and steelwork for the Waikato electric power scheme. (B.X. 2157).*

GISBORNE.—Borough Council. Diesel engine, alternators, and auxiliary plant, rotary converter, and switchboard. (See this issue.)

Oldham.—November 21st. Electricity Department. Three 12,500-kW turbo-generators and auxiliary plant. (October 30th.)

December 5th. Eight water-tube boilers, with superheaters, chain-grate stokers, steel chimneys, and induced draught plant. (November 6th.)

Pentre (Glam.).—November 16th. Rhondda Urban District Council Electricity Department. Two 35-h.p. and one 20-h.p., 400-V, squirrel-cage induction motors. (November 6th.)

Peterborough.—November 30th. Electricity Department. Buildings and civil engineering work, pulverised fuel equipment, two boilers and boiler-house equipment, one 6,000-kW turbo-alternator and turbine-room equipment, e.h.p. and l.p. switchgear, &c. (See this issue.)

Southall.—November 24th. Southall-Norwood U.D.C. Overhauling and maintaining the fire-alarm system. (See this issue.)

South Africa.—JOHANNESBURG.—December 14th. Electricity Supply Commission. Plant and material for transmission lines and sub-stations in connection with the supply of electricity in the Cape area rural districts.*

December 23rd. Union Tender Board. Telephone apparatus and supply of telegraph material for the Department of Posts and Telegraphs.*

December 17th. Municipal Council. 2,000-kW motor converter. (B.X. 2,142.)*

CAPE TOWN.—December 3rd. Electricity Department. Three-phase induction voltage regulators.*

Sub-station plant and transmission lines. (B.X. 2,139.)*

FORT BEAUFORT.—December 10th. Municipal Council. Generating plant and materials for electric lighting.*

QUEENSTOWN.—January 7th, 1926. Municipal Council. Extensions to the electricity undertaking.*

Uruguay.—MONTEVIDEO.—January 18th. State Electricity Supply Works. 170,000 metres of r.i. cords.*

January 29th. Fuse wire, enamelled lamp shades, cut-outs, switches, lampholders, sockets, &c. (B.X. 2,126.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Kirkcaldy.—Messrs. Yarrow & Co. (1922), Ltd., have secured a contract for Yarrow water-tube boilers, superheaters, and air heaters from Messrs. Michael Nairn & Co. (consulting engineers, Messrs. Kennedy & Donkin).

Hull.—Telephone Committee. Accepted:—
Insulators (£106).—W. F. Dennis & Co., Ltd.
Bell sets (£499).—Peel-Conner Telephone Works, Ltd.
Twin twisted wire (£156).—General Electric Co., Ltd.

Leeds.—Tramways Committee. Accepted:—
75 tramcar bodies (£1,390 each).—English Electric Co., Ltd.
75 tramcar bodies (£1,397 each).—Brush Electrical Engineering Co., Ltd.
190 pivotal trucks (£290 each).—Electro-Mechanical Brake Co., Ltd.

Electricity Committee. Accepted:—
Cables.—W. T. Henley's Telegraph Works Co., Ltd. (£5,362); Enfield Cable Works, Ltd. (£2,163); Macintosh Cable Co., Ltd. (£1,160).

London.—LONDON COUNTY COUNCIL.—
Six months' supply of portable accumulators.—Edison Swan Electric Co., Ltd.

H.M. Office of Works. Accepted:—
Switchboard for Royal Courts of Justice.—Park Royal Engineering Co., Ltd.

Maidstone.—Town Council. Accepted:—
Transformer (£187).—Johnson & Phillips, Ltd.
Air ducts for a new turbine (£60).—Jacksons, Ltd.

Notts.—County Education Committee. Accepted:—
Installation of non-automatic electric lighting set at Hopwell Hall (£429).—H. Barker, Ltd.

Sheffield.—Tramways Committee. Accepted:—
50 car bodies on trucks (£69,500); 50 trucks, complete (£16,700); to Maley's electro-pneumatic air-brake sets (£8,750).—Cravens, Ltd.
110 traction motors (£18,315).—Metropolitan-Vickers Electrical Co., Ltd.
100 tramcar controllers suitable for electro-pneumatic brakes (£8,745); 10 ditto, with standard fittings (£854).—British Thomson-Houston Co., Ltd.
50 rheostats (£550).—Electro-Mechanical Brake Co., Ltd.
100 automatic circuit breakers (£485).—Metropolitan-Vickers Electrical Co., Ltd.
50 trolley base boom and head sets (£973).—Brecknell, Munro & Rogers, Ltd.
50 sets e.l. fittings, switches, and fuses (£456).—General Electric Co., Ltd.
50 "Numa" air signal sets (£222).—Equipment & Engineering Co., Ltd.
50 traction-type lightning arresters (£137).—British Thomson-Houston Co., Ltd.

Winchester.—Education Committee. Accepted:—
Installing electric lighting at the Girls' County School.—Dick, Ltd.

Forthcoming Events.

Faraday Society.—Monday, November 16th. At Burlington House, Piccadilly, W.1. At 8 p.m. Ordinary meeting.

Derby Society of Engineers.—Monday, November 16th. At Derby. Paper, "Notes on Starters for a.c. Motors," by Mr. O. C. Dinerman.

Institution of Civil Engineers.—Tuesday, November 17th. At the Institution, Great George Street, S.W. At 6 p.m. Paper on "The Mechanical Properties of Steel," by Mr. W. E. Dalby.

Paisley Association of Electrical Engineers.—Tuesday, November 17th. At Gibson's Tea Rooms, 16, High Street. At 7.30 p.m. Paper on "Individual Motor Driving," by Messrs. G. S. Young and C. E. Downer.

Association of Engineering and Shipbuilding Draughtsmen (Birmingham Area Technical Committee).—Wednesday, November 18th. At the Birmingham Chamber of Commerce. At 7.30 p.m. Lecture on "The Design of Shafts for Bending and Torsion," by Mr. F. H. Boden.

Edinburgh Electrical Society.—Wednesday, November 18th. At the Royal Scottish Society of Art. At 8 p.m. Paper on "Stationary Batteries for Country House Lighting and Power Station Work Generally," by Mr. E. C. McKinnon.

Electrical Power Engineers' Association (West Yorkshire Section).—Thursday, November 19th. At the Cinema Exchange Theatre, Leeds. At 7 p.m. Lecture on "Modern Switchgear and Protective Devices," by Mr. W. A. A. Burgess.

British Electrical and Allied Manufacturers' Association.—Thursday, November 19th. At the Connaught Rooms. Annual dinner. 7 for 7.30 p.m.

Institution of Electrical Engineers.—Thursday, November 19th. At the Institution, Victoria Embankment, W.C. Lecture on "The Engineer: His Due and His Duty in Life," by Mr. T. Carter.

(Mersey and North Wales (Liverpool) Centre).—Monday, November 16th. At the University, Liverpool. At 7 p.m. Lecture on "The Engineer: His Due and His Duty in Life," by Mr. T. Carter.

(North-Western Centre).—Tuesday, November 17th. At the Engineers' Club, Manchester. At 7 p.m. Paper on "Dielectric Problems in High-voltage Cables," by Mr. P. Dunsheath.

(East Midland Sub-Centre).—Tuesday, November 17th. At Leicester. At 6.45 p.m. Paper on "Steam Pipes for Extra-high-pressure and Temperature," by Mr. J. A. Aiton.

(Sheffield Sub-Centre).—Wednesday, November 18th. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Paper on "The Application of Electro-Pneumatic Machinery to Colliery Surface Plants," by Mr. A. R. Cooper.

Institution of Mechanical Engineers.—Friday, November 20th. At the Institution Storey's Gate, S.W. At 6 p.m. Paper on "Characteristics and Uses of Ground Gears," by Mr. H. F. L. Orcutt.

Diesel Engine Users' Association.—Friday, November 20th. At the Caxton Hall, Westminster, S.W. Discussion on "Heavy-Oil Engine Working Costs."

Junior Institution of Engineers.—Friday, November 20th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "De-Hydration of Tar," by Mr. G. E. Wills.

Manchester Electro-Harmonic Society.—Friday, November 20th. At the Albion Hotel, Piccadilly, W. Concert.

E.D.A. Conferences.—Friday, November 20th. At Caxton Hall, S.W. Address on "Assisted Wiring Schemes," by Mr. I. Edgar.

Electrical Trades Commercial Travellers' Association.—Saturday, November 21st. At the Manchester Hotel, E.C. At 7.30 p.m. Whist drive and social.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, November 21st. At the South Wales Institute of Engineers, Park Place, Cardiff. At 6 p.m. Paper on "The Education and Training of Mining Electrical Engineers," by Mr. T. J. Nelson.

Notes.

Salaries of Disabled Men.—The following letter is to hand at the moment of going to press:—

"On Wednesday we celebrate the 7th anniversary of Armistice Day, and our thoughts will be with those men who fought and died in the service of their country. Many men fought also, who, though escaping with their lives, paid the price for their patriotism in the maiming of their bodies.

"A number of these disabled men, by dint of hard study and, in some cases, the expenditure of considerable money, have attempted to overcome their infirmities and fit themselves for responsible positions in the electrical engineering industry. Notwithstanding all this, many of them find themselves to-day engaged in a hand-to-hand fight with poverty owing to the meagre salaries being doled out to them by their employers. Cases are known to the writer, of men with good technical qualifications who are receiving salaries of between £2 2s. and £2 10s. per week while engaged on the staffs of large successful companies.

"May I appeal to all employers to give kinder consideration to the claims of disabled men in their employ, and so recompense them to a small extent for sacrifices they have made?

November 9th, 1925. Anco."

Train Collision Report.—We have received a copy of the report of the official inquiry into the circumstances attending the collision between an electric locomotive and a passenger train, which occurred at the Baker Street extension station on the Metropolitan Railway on June 14th. The evidence given was contradictory and it was concluded that the locomotive must have passed a signal in the danger position.

Appointments Vacant.—Junior charge engineer, for the Gloucester Corporation electricity works; carpenter and electrical wireman, for the Hastings Corporation electricity department; electrical engineer, for the Aldershot Gas, Water and District Lighting Co.; assistant electrical engineer (Rs. 700 per mensem), for the Madras Electric Supply Corporation, Ltd.; lecturer in electrical engineering, for the Bradford Technical College; testing assistant (£200), for the Borough of Derby electricity department; assistant electrical engineer (temporary), for the Ealing Corporation electricity supply department; consumer's engineer (£300), for the West Gloucestershire Power Co., Ltd. (See our advertisement pages to-day.)

Local Societies.—The EDINBURGH ELECTRICAL SOCIETY recently paid a visit to the automatic telephone exchange which is being installed for Edinburgh and district, and on November 4th the visit was followed up by a lecture given by Mr. W. J. H. Piper in the Post Office classroom, where a model exchange had been erected for demonstration.

YORKSHIRE ASSOCIATION OF CIVIL ENGINEERS.—Speaking at the opening meeting of the session of the Association, at Sheffield, Colonel H. Rhodes, mining engineer, this year's president, dealt with the coal industry, and said, generally, it might be said that at 90 per cent. of the collieries in this country electricity had been adopted as the motive power for the bulk of the subsidiary operations, the chief use to which steam was applied direct being for driving the winding engines. The indirect advantages to be derived from the adoption of electric winding would bring it more and more to the front. One of the most expensive items in modern winding plants was ropes, and he believed it was becoming increasingly recognised that the even turning movement and steady acceleration and deceleration of electric winding plants added to the useful life of the ropes.

Fatality.—Grasping a portable electric lamp with one hand and placing the other on a steel girder, James Glover, of Nottingham, was killed recently at the Colwick Beet Sugar Factory.

Research in New Zealand.—According to the *Daily Mail's* Christchurch correspondent, the New Zealand Government has referred to Professor Sir Ernest Rutherford, who has recently been visiting that country, for his advice on the question of the relationship of science and industry there, with special reference to the report of the Special Committee set up to consider the needs of New Zealand manufacturers with regard to scientific industrial research.

Railway Fog Signals.—The Southern Railway Co. is introducing a new signalling system on its suburban lines. The signals will be provided with four lights, which will indicate various instructions to the drivers of trains; the important point about these lights is that they will be on a level with the driver's eyes and will be far more powerful than any used hitherto, so that they will be able to penetrate through fog to a much greater extent.

St. Dunstan's.—The tenth annual report of this institution reminds us that although the Great War is passing into history, the good work of helping those of the Services who lost their sight to help themselves is still being carried on. The list of successes in aiding these men to surmount their serious handicap is gradually growing, and St. Dunstan's men are now making headway in a number of fields of activity.

Reinforced Concrete Pipes.—In a lecturette delivered to the Junior Institution of Engineers, on October 23rd, Mr. H. S. Bower described the construction and laying of reinforced concrete pipes. He said that the method recently adopted in the laying of a pipe line for carrying water in Spain was to use for the principal reinforcement thin steel sheets formed into cylindrical sections and welded together at all joints, about four of these sections making one twelve-foot length of pipe. A wire reinforcement was wound on to the outside of the steel shell, and a spiral wire cage was made on a former and then removed to the inside of the pipe to form a key to keep the concrete in place. The internal lining of concrete, which consisted of a two to one mixture of cement and sand, was spun into position by mounting the pipe on rollers and rotating it at a peripheral speed of about 37 feet per second after the proper quantity of concrete had been poured in. The concrete thus obtained was extremely hard and much denser than cast concrete. To receive its exterior coat of three to one concrete the pipe was placed in a split mould. Bends and special pipes were plastered by hand.

Each pipe was provided with a socket at one end for jointing purposes, joints being made by a rough bonding from the inside with quick-setting cement and then caulking from the outside between the socket of one pipe and the spigot end of the next with lead pipe filled with hemp. An additional short collar of the same steel section as the pipe was then slipped over the joint, a mould put round, and the whole grouted in to form a homogeneous joint. The interior of the pipe was finished off smoothly by a man who moved along inside on a small flat trolley.

A Solid Smokeless Fuel Conference.—Under the joint auspices of the Chemical Engineering Group and the Yorkshire Section of the Society of Chemical Industry, and the Institutions of Chemical Engineers, Gas Engineers, and Mining Engineers (Midland), a conference on "Solid Smokeless Fuel" will be held at the Mappin Hall, Sheffield University, on November 20th, under the chairmanship of Sir Arthur Duckham, K.C.B. The conference will be a continuation of the joint meeting of the Chemical Engineering Group and the Institution of Chemical Engineers, which was held in the University, Leeds, in July last. The Department of Fuel Technology of the University has arranged exhibits of the results of its research work. Tickets for admission to the meetings may also be obtained from the hon. secretary, Chemical Engineering Group.

Street Flood Lighting Experiment.—Flood lighting is to be used for illuminating Fitzalan Square, Sheffield. A 750-c.p. lamp has been fixed at each of the four corners and fitted with lenses and mirrors to enable the beam to be directed towards any desired place.

The North Wales Dam Accident.—The accompanying illustrations show respectively the wash-out beneath the concrete dam at Llyn Eigiau, which was the initial cause of the trouble, and the breach in the dam at Coedty Reservoir, which resulted from the overflow consequent upon the former. For the photographs, taken by Mr. J. W. Griffith, M.Inst.C.E., we are indebted to Mr. Theodore Stevens, whose account of his investigations will be found on p. 772 of this issue.

Fig. 1.—The Wash-out beneath the Eigiau Dam.

Fig. 2.—View through the Breach at Coedty.

Faraday House Old Students' Association.—ANNUAL DINNER.—On Friday last the annual dinner of the Association was held at the Piccadilly Hotel, London; the president, Mr. H. W. H. Richards, M.I.E.E., was in the chair, and amongst the 180 present were many distinguished guests, including Mr. R. A. Chattock, Sir John Snell, Sir R. A. Hadfield, Dr. S. Z. de Ferranti, Sir James Devonshire, Sir Benjamin Longbottom, Mr. W. W. Lackie, Mr. S. L. Pearce, Col. Purves, Mr. C. P. Sparks, Sir Charles Morgan, and Mr. W. O. Smith.

After the loyal toasts, Mr. R. A. Chattock, president I.E.E., proposed "Faraday House and its Old Students," remarking that the number of students had doubled in ten years, and that the testing department was of great value to the industry. The high positions attained by the old students should encourage those now attending—he had found the old Faradians good men. Doctor Russell, their beloved principal, added to great scientific abilities a geniality and helpfulness which instilled into his students the desire to be of service to others, which was so necessary but so often wanting nowadays. Dr. Alex. Russell, F.R.S., responding, referred to the many distinctions gained by old Faradians during the past year, including 143 appointments, to the completion of the new laboratories, and to the increase in the teaching staff.

Mr. G. W. Partridge, M.I.E.E., proposed "The Guests," pointing out that amongst the many eminent engineers present were seven past-presidents of the I.E.E., and three of the Electricity Commissioners. Sir John Snell, G.B.E., responded, remarking that no other educationalist had so much personal influence over his students as Dr. Russell. He confidently anticipated a great extension of railway electrifica

tion both at home and in the Dominions, and of hydro-electric development, which he hoped to see in British hands. Dr. S. Z. de Ferranti also responded to the toast, referring to the great help he had received in the early difficult days from the most capable men. Great electrical developments were in prospect, calling for the services of many qualified electrical engineers, and Faraday House was doing splendid work in providing just the right sort of men, in quite the best way, thanks to the influence of Dr. Russell. Sir Charles Morgan, C.B.E., proposed the health of the chairman, whose success, he said, was due to character and personality, backed by hard work, and Mr. Richards briefly replied, expressing his indebtedness to Dr. Russell.

An excellent entertainment was provided, and the proceedings closed with "Auld Lang Syne."

Cable Ship in Distress.—A S.O.S. message was received at Valentia on November 6th, says *The Times*, from the cable-ship *Lord Kelvin*, stating that she had met with heavy weather in Lat. 49.40 N., Long. 29.43 W., and that part of her superstructure had been carried away, but that she was out of immediate danger and still under control. According to a later message, she was running before a heavy gale from the south-west in a seaworthy condition. The *Lord Kelvin* is a vessel of 2,641 tons, built in 1916 by Swan, Hunter and Wigham Richardson, Ltd., and owned by the Anglo-American Telegraph Co. She was last reported at Halifax in the middle of September.

Institution Notes.

Institution of Electrical Engineers.—PROGRAMMES.—The arrangements for the new session include the following provincial items:—

SCOTTISH CENTRE.

December 2nd.—Annual dinner.
December 8th.—Major E. I. David. "Electricity in Mines."
January 12th, 1926.—Mr. H. M. Sayers. "Electricity Supply Tariffs."

SOUTH-MIDLAND CENTRE.

November 27th.—Annual dinner.
December 2nd.—Prof. S. P. Smith. "An All-Electric House."
January 13th, 1926.—Mr. C. E. Webb. "The Power Losses in Magnetic Sheet Material at High Flux Densities."

WESTERN CENTRE.

November 30th.—Mr. J. H. Thomas. Lecture on "Switchgear Developments during the Past 20 Years."
January 11th, 1926.—Address by the President, Mr. R. A. Chattock, and annual dinner.

DUNDEE SUB-CENTRE.

December 10th.—Mr. J. K. Murray. "Some Features of Telegraph Engineering."
January 14th, 1926.—Mr. W. M. Mackay. "Atmospheric Electricity."

EAST-MIDLAND SUB-CENTRE.

November 17th.—Mr. J. A. Aiton, C.B.E. "Steam Pipes for Extra-High-Pressure and Temperature."
December 8th.—Mr. F. J. Moffett, B.A. (chairman of South-Midland Centre). Address.
January 19th, 1926.—Mr. A. B. Mallinson. "Justifiable Small Power Plant."

HON. MEMBER.—In opening the meeting of the Institution on November 5th, the president announced that the Council had that day elected Dr. S. Z. de Ferranti an honorary member of the Institution. A past president, Dr. Ferranti has been a full member since 1891.

WESTERN CENTRE.—At a meeting of the Western Centre of the Institution at Bristol on November 2nd, under the chairmanship of Mr. J. W. Burr, Mr. J. W. Beauchamp (director of the British Electrical Development Association) lectured on "Domestic Electrification." He thought the Institution should have at least one meeting each year dealing with electricity in the home. He asked for the assistance of women to introduce it into their homes. They were the greatest buyers in the world.

By means of lantern slides, Mr. Beauchamp demonstrated suitable methods of lighting drawing-rooms and bedrooms, and stressed the importance of having a light behind the head when reading or writing. England was a mass producer of electric cooking stoves. Electricity also played a big part in feeding the train-travelling public, and in the kitchens of most of the large London restaurants it was in use. One of the latest uses to which electricity had been put was baking bread. It had been found that one ounce of dough less was required in a loaf cooked by electricity, and 10 per cent. was saved by cooking meat electrically.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Mr. A. G. ELLIS, the Chairman of the North-Western Centre of the Institution of Electrical Engineers, whose portrait appears herewith, was a student under the late Prof. S. P. Thompson at the City and Guilds Technical College, Finsbury, from 1899 to 1901. Later he was at the Central Technical College under the late Prof. W. E. Ayrton and Prof. T. Mather. In 1903 he joined the Fuller-Wenstrom Electric Manufacturing Co., and in the following year went to the Northampton Institute as assistant to Dr. C. V. Drysdale. In 1905 Mr. Ellis became assistant to Mr. H. M. Hobart, eventually becoming his chief assistant. He went to Switzerland in 1909, joining the Société d'Electricité, Alioth, Basle, as designing engineer for a.c. generators, transformers, relays, &c., and after the amalgamation, in 1911, of the company with Messrs. Brown, Boveri & Co., he was placed in charge

J. Ingham & Sons] *[Bowdon, Cheshire*

Mr. A. G. Ellis,
Chairman of the N.W. Centre, I.E.E.

of the transformer department at the Alioth works. From 1913 to 1916 he acted as vice-chief of the transformer department of Messrs. Brown, Boveri's Baden works. He left Switzerland in 1916 to join the Metropolitan-Vickers Electrical Co., as chief engineer of the company's transformer department, and he still occupies that position.

While he has been with the Metropolitan-Vickers concern he has been responsible for the design and construction of the largest and highest-voltage transformers yet built in this country, including the 19,500-kVA, 33,000-V, 3-phase units for Barton, Manchester, and the 25,000-kVA, 132,000-V outdoor 3-phase groups for the Victoria Falls Power Co. Mr. Ellis's principal work of late years has been an endeavour to establish the British competitive position in the world's markets in large transformers, especially for outdoor sub-station work. He is also interested in standardisation, being a member of the Transformer and Insulating Oils Committee of the B.E.S.A., and the chairman of the Transformer Technical Committee of the B.E.A.M.A. In his earlier days Mr. Ellis was successively hon. secretary and chairman of the London Students' Section, and from 1920 to 1923 was hon. secretary of the North-Western Centre, on whose committee he has been since 1918.

Mr. Ellis has written three technical books—"Alternating Current Dynamo Design," "Armature Construction," and (with Mr. Hobart) "High-speed Dynamo-Electric Machinery." Two papers by him have been published in the I.E.E. Journal—one on "Steam Turbine Dynamos" and the other (with Mr. Thompson) on "Large Power Transformers." Mr. Ellis is a member of the Society of Technical Engineers, the Decimal Association, and Engineers' Clubs of London and Manchester.

Mr. WILFRID S. TAYLOR has resigned his position as managing director of the Liverpool Electric Cable Co., Ltd., and has severed his connection with it. Mr. Taylor was one of the founders of the business, along with his father, 24 years ago, and during the last 14 or 15 years he has been mainly responsible for the company's progress and advancement. Mr. Taylor is leaving at the end of the week for a holiday in the South of England, but we are asked to say that any communications may be sent to him at his private address, 9, Caithness Drive, Wallasey.

Senor GUSTAVO LIRA, manager of the Electrical Department of the Chilean Ministry of Public Works, has been appointed Minister of Public Works.

Messrs. HENRY LEA & SON, of Birmingham, have been appointed consulting engineers for the new Naval School, which the Admiralty is about to build near Ipswich.

Col. O. C. ARMSTRONG, chairman of Messrs. Greenwood and Batley, Ltd., has been appointed a member of the Credit Insurance Committee by the Parliamentary Secretary to the Department of Overseas Trade.

We regret to learn that Capt. R. J. WALLIS-JONES, M.I.E.E., who is so deservedly popular in electrical circles, has been seriously ill; his many friends will join with us in wishing him a speedy recovery.

Mr. E. J. WALSH, A.M.I.E.E., who prior to opening business on his own account, was engineer and manager of the Musselburgh E.L. & Tramway Co., has been elected a member (Moderate) of the Musselburgh Town Council.

At Day's Café, Dewsbury, recently, a gathering took place of members of the staff of the Yorkshire Electric Power Company, to make presentations of a canteen of cutlery to Mr. J. S. PICKLES, and a set of oxidised silver vases to Mr. ARNOLD PICKLES, and their wives. Both gentlemen are members of the mains construction staff, and have been recently married.

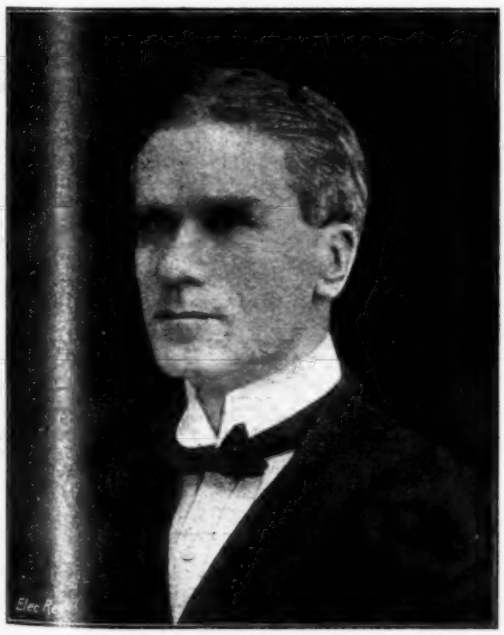
The Beckenham Urban Council is increasing the salary of the electrical engineer from £600 basic salary, plus £189 bonus, to £800, rising by annual increments of £25 to £1,000.

Messrs. Walker Vehicles, Ltd., have appointed Mr. RAYMOND J. MITCHELL, M.I.E.E., M.I.Mech.E., M.I.A.E., to the position of development engineer at the headquarters at Clare House, Kingsway, W.C.2.

Professor F. W. BURSTALL, M.Sc., M.A. (Cantab.), M.I.Mech.E., head of the Mechanical Engineering Department of the University of Birmingham, and sometime Dean of the Faculty of Science, has been appointed Vice-Principal of the University, in succession to Sir William Ashley.

Mr. H. M. SAYERS, M.I.E.E., informs us that his telephone number is "Streatham 5577."

The accompanying portrait is of Alderman DUNCAN WATSON, the first chairman of the new Joint Electricity Authority for the London and Home Counties Electricity District, a report of the inaugural meeting of which appears in this issue, page 793. Mr. Watson is proprietor of Messrs. Duncan Watson and Co., electrical engineers. He graduated in Glasgow, and many of his friends in Scotland will not be surprised to learn that he has gained the confidence of his colleagues in London to the extent of placing him at the head of the biggest electrical authority in the country. Alderman Watson has a record of service which may be envied by many public spirited men. He was elected borough councillor at St. Marylebone in 1909, in which capacity he remained till 1915, when he was honoured with his aldermanship. He was Mayor of the Borough for the year 1919-20. He has been a member of the Electricity Committee since 1912, and was chairman during the years 1914-1917, and vice-chairman from 1921 to 1923. The Alderman has also served and is still serving on several other Committees of the Council. He was appointed a Justice of the Peace in 1933. In 1918 he was given the chairmanship of the Conference of Local Authorities Owning Electricity Undertakings in Greater London, and this position he has held until now.



Elec Rev

Hana] **Ald Duncan Watson,** [London.
Chairman of the London Electricity Authority.

Mr. F. MORLEY WARD, M.I.E.E., whose photograph accompanies these notes, and who was appointed general manager of the Relay Automatic Telephone Co., Ltd., in 1920, has severed his long connection with the Relay system, and proposes taking a rest before engaging in future activities. Mr. Ward (with Col. C. B. Clay, who resigned early last year) was engaged by the Marconi Co. to develop world-wide patents for the Betulander automatic (electro-mechanical) telephone system, and in 1913 demonstrated the apparatus in Paris on the occasion of the visit of the Institution of Electrical Engineers to the Société des Ingénieurs Electriciens, afterwards taking another demonstration plant to Italy. Later Mr. Ward spent several months in Sweden in investigating developments, which eventually led to Betulander's invention of the Relay system. This new system was only brought to England a few months before the war. We understand that Mr. Ward, as chief engineer of the company, was responsible for developing and improving the Relay system to meet British requirements, and in this connection took out numerous patents.

Elliott & Fry] [*London.*
Mr. F. Morley Ward, M.I.E.E.

Obituary.—MR. G. DUTHIE SMITH.—We regret to record the death of Mr. Geo. Duthie Smith, chief assistant with the Chiswick Electricity Supply Co., Ltd. Mr. Smith was a son of the late Mr. Alex. Smith, gas engineer, Aberdeen. He served his apprenticeship with Messrs. McKinnon & Co., Ltd., engineers, Spring Gardens, and spent several years in Glasgow, Halifax, and New Southgate, London, before entering the service of the Chiswick Electricity Supply Co., Ltd., where he had been for the past 20 years.

Will.—MR. R. GRANT, of Prestwich, branch manager of Messrs. Stewart & Lloyds, Ltd., left £16,168 net and £17,784 gross personalty.

New Companies Registered.

Fluor Light, Ltd. (209,430).—Private company. Registered November 4th. Capital, £1,000 in 10s. shares. Objects:—To adopt an agreement with H. A. Wolfe and G. A. Williamson to develop and turn to account the several inventions described in certain agreements entered into by them and referred to in the above agreement, and to carry on business as manufacturers of luminous electrical signs, devices, ornamental and decorative work, electrical, mechanical, and other advertising signs, material for electrical and other illumination work, electrical transformers, &c. The first directors are:—J. I. McCan, "Sarnia," East Sheen, Surrey, medical practitioner; H. A. Wolfe, 33, Basnett Road, W.10, inventor; J. H. Mendoza, 22, Bellingham Road, S.E.6, legal agents' manager; G. A. Williamson, 12, Holmesdale Avenue, East Sheen, legal agents' manager. The last two named are joint managing directors. Qualification, 1 share. Remuneration of the above £100 per annum. Secretary: G. W. Williamson. Registered office: Thanet House, 231-232, Strand, W.C.2.

Crosby (Liverpool), Ltd. (209,492).—Private company. Registered November 5th. Capital, £500 in £1 shares. Objects:—To carry on the business of electric light and general electrical engineers, manufacturers of, and dealers in electric light and other electrical apparatus, &c. The first directors are:—H. E. Fillingham, "The Homestead," Hightown, Liverpool, electrical factor (permanent); J. Bennett, 76, Chester Road, Chester, traveller; E. W. Jones, 3, Fairholme Road, Crosby, traveller. Qualification, 25 ordinary shares. Remuneration as fixed by the company. Solicitors: W. & J. Cooper, Preston. Registered office: 63, Tithebarn Street, Liverpool.

W. Mackie & Co., Ltd. (209,490).—Private company. Registered November 5th. Capital, £12,000 in £1 shares. Objects:—To acquire the business of electrical and mechanical engineers lately carried on by the late M. W. W. Mackie, and to carry on this and the business of wireless engineers, &c. The first directors are:—E. Mackie (chairman), "Willowmay," Hythe End, Wraysbury, Bucks.; J. Rook (managing director), 45, Broomfield Avenue, Palmer's Green, N.13; G. A. Butt, 20, Vincent Road, West Green, N.15, accountant. Qualification, 1,000 shares. Solicitor: E. Mackie, 51, The Mall, Ealing. Registered office: Palace Engineering Works, 129-133, Lambeth Road, S.E.1.

Western Electric Co., Ltd. (209,405).—Private company. Registered November 2nd. Capital, £100 in £1 shares. Objects:—To carry on business connected with the purchase and sale of telephones, telephonic, telegraphic, and electric lighting apparatus, instruments, and machinery, electric cables and wires, and electrical goods of all kinds, &c. The first directors are:—H. A. P. Disney, "Uphanger," Chorley Wood, Herts., secretary; G. D. Colclough, 73, Burton Court, Sloane Square, S.W.1, solicitor. Solicitors: Johnson, Jecks & Colclough, 24, Austin Friars, E.C.2.

Official Returns of Electrical Companies.

East Anglian Electric Supply Co., Ltd.—Particulars filed of £20,000 debentures authorised by resolutions of June 10th and October 9th, and covered by trust deed dated October 23rd, 1925, constituting a specific charge on certain freehold properties at Stowmarket, Felixstowe, Sudbury, Framlingham, and Needham Market, with appurtenances thereto, and buildings, plant, and machinery, and a floating charge on the remainder of the undertaking and assets, including uncalled capital, the whole amount being now issued. Trustees: Lt.-Col. H. W. Woodall, C.I.E., M.I.C.E., and Mrs. E. N. Woodall, Stinsford House, Dorchester; and C. W. Woodall, 34, Great Tower Street, E.C.2.

Telephone Co. of Pernambuco, Ltd.—Particulars filed of £150,000 8 per cent. registered debentures authorised October 20th, 1925, and covered by trust deed of the same date, charged on the company's undertaking and property, present and future, including uncalled capital, and all existing and future concessions and contracts relating to the provision and operation of telephone services. None issued. Trustees: Witan Investment Co., Ltd., 28, Austin Friars, E.C.

Willesden Electric, Ltd.—W. R. Clemens, of Alderman's Walk, Bishopsgate, E.C.2, ceased to act as receiver on June 5th, 1925. (Notice filed on October 30th.)

A. Lippold, Ltd.—G. J. Davey, of 267, Mitcham Lane, Streatham, S.W.16, ceased to act as receiver or manager on October 28th, 1925.

Direct West India Cable Co., Ltd. (53,956).—Capital, £120,000 in £5 shares. Return dated October 8th, 1925. 120,000 shares taken up. £60,000 paid. Mortgages and charges: Nil.

W. R. Sykes Interlocking Signal Co., Ltd. (93,078).—Capital, £50,000 in 87,500 "A" and 12,500 "B" shares of 10s. each. Return dated October 28th, 1925. 42,297 "A" and 12,500 "B" shares taken up. £10,513 12s. 6d. paid, being 5s. per share on 42,297 "A" shares, less £60 12s. 6d. calls unpaid. £16,824 5s. considered as paid, being 10s. per share on 12,500 "B" and 5s. per share on 42,297 "A" shares. Mortgages and charges: £17,526.

Marconi's Wireless Telegraph Co., Ltd. (53,403).—Capital, £4,000,000 in 3,750,000 ordinary and 250,000 7 per cent. cumulative participating preference shares of £1 each. Return dated August 14th, 1925. 3,249,913 ordinary and 250,000 preference shares taken up. £3,383,888 paid on 3,133,888 ordinary and 250,000 preference shares. £116,025 considered as paid on 116,025 ordinary shares. Mortgages and charges: £1,373,906 12s. 4d.

Coniston and District Electric Supply Co., Ltd. (138,478).—Capital, £2,000 in 1,500 6 per cent. preference and 500 ordinary shares of £1 each. Return dated October 10th, 1925. 1,440 preference and 500 ordinary shares taken up. £1,660 paid on 1,440 preference and 220 ordinary shares. £280 considered as paid on 280 preference shares. Mortgages and charges: Nil.

B.N.B. Wireless, Ltd.—Satisfaction in full on September 10th, 1925, of debentures dated November 22nd, 1925, securing £100.

City Notes.

Reports and Meetings of Electrical Companies; Dividend Results, &c.

Southern Brazil Electric Co., Ltd.

The annual meeting was held on November 4th, Mr. E. H. Tootal (chairman) presiding. In presenting the report and accounts, which were abstracted in our last issue (p. 749), the chairman said that the loss had risen from £18,900 in the previous year to £20,860 in the year under review. The directors, having reduced the arrears of income tax by £17,500, hoped that by the end of next year that indebtedness would have been entirely cleared off. The drought of which he spoke at the last meeting had continued well into September last, and had had a serious effect upon the company's business. The supply of current for industrial purposes had to be cut down to two days per week, the tramways ran reduced services, and private consumers were restricted to 60 per cent. of their normal requirements. Towards the end of September rains were experienced which enabled the supply to be slightly increased. During the drought period the supply had been maintained, and the Companhia Campineira was even able to supply excess current to other parties. Steps were being taken to raise the level of the Jaguary dam to ensure an increased volume of water for the future. During the past year the exchange at one time fell to below 5d., but it had improved to 7¼d. gradually and remained steady. A great deal of building activity was going on in the city of Sao Paulo, which should lead to increased demands for electricity. The demand from the coffee planters was steadily growing.

Aluminium Corporation, Ltd.

The annual meeting was held under the chairmanship of Mr. K. M. Clark on November 4th. Prior to presenting the report for the past year, the chairman made reference to the calamity which had occurred a day or two before. He stated that a big breach had been made in the long leg of the Eigiau dam, and the low-level dam had given way. A temporary supply was being given from Cwm Dyli, and it was expected to have a machine at work on that day (November 4th). The Cowlyd dam and the 3-ft. pipe were in good order. It was expected that a full supply of power from the company's own machines would be resumed in a week; in the meantime connections had been made to other steam stations in the eastern area. The chairman said that this was the second unfortunate set-back within the space of a year. In November last year a new and large pipe line gave out, rendering the entire installation useless. Prompt action had been taken, however, and a supply to the various towns was maintained without interruptions. It had been necessary practically to rebuild the pipe line, and it was only during the last month that it had been returned to active operation. Following the loss of the stored water, the past summer had been a dry one. In the circumstances the shareholders could not be surprised that the directors were unable to pay a dividend on the preference shares. Sales of metal during the past year had increased by about one-third, and the sale of energy by about 24 per cent. Prices were satisfactory and the demand for their products was in excess of their ability to supply. Before the latest calamity they had more furnaces at work than ever before in the company's history, and the recent rain had made their water position satisfactory. He thought that the company was about to secure the benefit of the very heavy constructional work which it had carried out. The report and accounts were adopted, and an expression of sympathy with the bereaved relatives of those killed in the bursting of the dam was made.

A. J. Stevens and Co. (1914), Ltd.

Speaking at the annual meeting on November 4th, the chairman (Mr. E. E. Lamb) said that the net result for the past year had been a profit of £42,116, to which was added £26,092 brought forward, making a total of £68,209. A dividend of 12½ per cent. was being paid on the ordinary shares for the sixth successive year. Referring to the Wireless Department, Mr. Lamb said that the re-built factory had been equipped with the latest machinery and plant for the economical production of apparatus, and the number of employés had been nearly doubled. The business had so increased that further accommodation was becoming a matter of urgency. The company had opened a large radio showroom in London.

German Companies.

The *Hanover Power Works Company*, which is owned by the State of Prussia, states that the output increased from 2.52 million kWh in 1923-24 to 41.41 millions in 1924-25. The accounts show a net profit of 210,000 marks, which has been carried forward.

The *Rheydt Cable Works Company* states that the works were well occupied in 1924. After writing off 558,000 marks for depreciation, the accounts show net profits of 1,058,000 marks, permitting of the payment of a dividend at the rate of 15 per cent.

The *Energy Industry Company*, of Berlin, which is associated with the Rhenish-Westphalian Electricity Works Company, has closed the year 1924-25 with a slight loss. The directors state that the general credit crisis practically stopped the construction of electricity works and extensions. On the other hand, more favourable results were obtained from the management of electricity supply and tramway undertakings.

French Companies.

The *Société de Constructions Électriques de Nancy* reports a profit of 326,000 fr. for 1924-25; this has been applied to depreciation and reserve funds, while 112,000 fr. has been carried forward.

The *Société d'Electro-Métallurgie de Dives* reports that the complementary installations for rolling and for the manufacture of tubes were finished and placed in operation in 1924-25. With the balance brought forward, the net profits amount to 12,047,000 fr., permitting of the payment of a dividend at the rate of 80 fr. per share.

Swiss Companies.

The *Electro Values Company*, of Basle, proposes to pay a dividend at the rate of 7 per cent. for 1924-25 on share capital of 20,000,000 fr., as compared with 4½ per cent. in the previous year.

The *Motor-Columbus Company for Electrical Undertakings*, of Baden, proposes to pay a dividend at the rate of 9 per cent. for 1924, out of net profits of 5,860,000 fr., as in the preceding year.

The *Watt Electrical Undertakings Company*, of Glarus, reports that the deficiency of 2.89 millions of francs brought forward has been reduced to 2.87 millions in 1924-25, and the directors propose a scheme of reorganisation under which the share capital will be reduced from 10,000,000 to 3,500,000 fr.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Consolidated Gas, Electric Light and Power of Baltimore.—140,257 shares of no par value, issued at $35, partly and fully paid, and fractional warrants.

Dubilier Condenser (1925).—15,000 ordinary shares of 10s. each, fully paid. Nos. 400,001 to 415,000.

Pettigrew and Merriman (1925).—435,600 ordinary shares of 5s. each, fully paid, Nos. 125,001 to 560,600.

Shawinigan Water and Power.—12,798 new shares of $100 each, fully paid.

The undermentioned securities have been ordered to be officially quoted:—

Callender's Cable and Construction Co., Ltd.—100,000 ordinary shares of £1 each, fully paid, Nos. 500,001 to 600,000.

Shropshire, Worcestershire and Staffordshire Electric Power Co.—32,625 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 1,127,376 to 1,160,000.

Prospectuses.—*Melbourne and Metropolitan Tramways Board.*—An issue of £300,000 5 per cent. stock, 1944, has been offered at £96 per cent. The proceeds will be used for the conversion of cable trams to electric, and in connection with the general scheme for the development of the Melbourne tramway system.

British Monomarks, Ltd.—This company, whose scheme was outlined in our issue of July 17th (p. 92), has now been formed and has issued a prospectus offering 150,000 ordinary shares of £1 each at par. The nominal capital consists of £20,000 in founders' shares and £230,000 in ordinary shares. The directors include Col. O. C. Armstrong, D.S.O. (Greenwood and Batley, Ltd.) and Lord Meston (English Electric Co., Ltd., and Calcutta Electric Supply Corporation, Ltd.).

Norwich Electric Tramways Co.—The report for the year ended June 30th last shows that the net profit increased by £4,304 to £20,916, the receipts having risen and the expenses decreased. The sum of £1,248 from the previous year was added to the net profit, making £22,165. It was proposed to transfer £10,000 to reserve, to pay a dividend of 4 per cent., and to carry forward £1,605. The number of car-miles run increased from 1,017,575 to 1,078,592, and the number of passengers carried from 12,386,659 to 13,529,680. The company inaugurated a motor-omnibus service in April last, and it is proposed to substitute 'buses for the trams on other routes where the returns are of a low order.

Kaministiquia Power Co.—An offer was made in Montreal last week of first mortgage, 25-year, 5½ per cent. sinking fund gold bonds, series "A," to the extent of $2,000,000. The *Financial Times* states that an amount of £205,000 5½ per cent. first mortgage debenture stock, series "A," ranking *pari passu* with the above bonds, will be placed in London shortly. The transfer of the undertaking to the new company is stated to be completed, and the proceeds are being distributed in the form of cash and preferred stock to the holders of the old company's common shares. No distribution is being made on the common shares in respect of the quarter just ended.

Amazon Telegraph Co., Ltd.—The report for the year ended June 30th last states that the gross revenue amounted to £52,980 and the working expenses to £27,256. After providing for taxation and debenture interest and transferring £15,305 to the sinking fund and £2,000 to general reserve, there remains a balance of £372, to which is added £3,066 brought forward, making £3,438. The directors propose to carry this balance forward. The report mentions the death of Mr. Ellice-Clark, who had been a director since 1901. The meeting is to be held on November 17th.

Agar, Cross & Co., Ltd.—The available balance at the close of the past financial year (including £39,441 brought forward) was £351,391. The allocations include £120,000 to general reserve, £10,000 to income tax reserve, and a final dividend and bonus on the ordinary shares, making 16 per cent. for the year, free of tax. It is proposed to capitalise £225,000 of the reserve and distribute it in £1 shares to the ordinary shareholders in the proportion of one new share to each two held.

Radio Corporation of America.—For the second quarter in succession the returns for the three months ended September 30th showed a deficit of $358,275, although for the first nine months of the year there was a surplus of $1,179,001. The adverse result is stated to be due to the drastic price-cutting resorted to by competitors.

Guest, Keen & Nettlefolds, Ltd.—Interim dividends at the rate of 5 per cent. per annum on the first and second preference shares, and of 1s. per ordinary share, all free of tax, have been declared in respect of the six months to September 30th last. These dividends are similar to those paid last year.

Electric Construction Co., Ltd.—The following interim dividends have been declared in respect of the year ending March 31st next:—Preference shares: At the rate of 7 per cent. per annum; ordinary shares: At the rate of 6 per cent. per annum.

German Loan in America.—Debentures of the Hamburg Electrical Works to the extent of $4,000,000 were offered in New York recently. The bonds, which mature in 1935, bear interest at the rate of 7½ per cent. and were offered at 95½.

Para Electric Railways and Lighting Co., Ltd.—The interest on the 5 per cent. first debenture stock in respect of the half year ending November 30th is being paid on December 1st.

National Telewriter Co.—The first distribution made by the company since its inception in 1909 is announced. This is a dividend of one per cent. on the 7 per cent. cumulative participating preferred ordinary shares.

Siemens Bros. & Co., Ltd.—An interim dividend of 2½ per cent., less tax, has been declared on the ordinary shares, as in 1924.

Cawnpore Electric Supply Corporation, Ltd.—An interim dividend of 3 per cent. has been declared on the ordinary shares, as in 1925.

Madras Electric Supply Corporation, Ltd.—The directors have declared an interim dividend of 2½ per cent., free of tax, as last year.

W. T. Henley's Telegraph Works Co., Ltd.—The directors have declared an interim dividend on the ordinary shares of one shilling per share, less tax.

Johnson & Phillips, Ltd.—An interim dividend of 7½ per cent. has been declared on the ordinary shares. The dividend for the whole of 1924 was 10 per cent.

Anderston Foundry Co., Ltd.—The directors state that they do not propose to pay an interim dividend.

Stocks and Shares.

MONDAY EVENING.

COMMENT upon movements in prices, and upon the causes that produce them, occupy a second place of importance nowadays. The prices themselves are the centre of interest and of attraction. The remarkable rises that occur, every week, in shares of manufacturing companies are watched with the liveliest interest by people who know that the advances are due to the knowledge of the companies' profitable activities. Speculation has entered the field, thrusting its orders into the press of others that originate with investment pure and simple. Together, the two species of demand have led to the market developing what would be a condition of buoyant activity if there were a sufficiency of supply for all who desire to buy shares. But, as things are, stock is in short supply, and this forces a restriction upon business.

Johnson & Phillips at 59s. 3d. are 4s. 6d. up. Siemens have risen 3s. 6d. Enfield ordinary strengthened to 3¾. Automatic Telephones at 50s. are 2s. 6d. better. Prices seemed to be rampant at the end of last week. A slightly easier tone evidenced willingness to take profits a few days later. Prices held most of their ground, but a few people began to ask whether the boomlet had not already proceeded quite far enough. Therefore the quotations are not at the highest recently reached.

Edisons eased off to 9s. and General Electrics to 28s. 6d. English Electrics continue to be a good market, ordinary and preference both showing improvements. The engineering section retained most of its strength, though Babcocks reacted to 51s. 3d. Shares connected with the "heavy" trades of the country were bought in advance of what was anticipated would prove an optimistic speech from the Premier at the Guildhall banquet this, Monday, night.

Cable stocks and shares have thrown off all their previous dulness and prices have materially improved. Eastern ordinary stock rose 4; Eastern Extensions, Globe ordinary and Westerns are all 5s. to the good. Rumours of a possible increase in the Bank Rate hold no terrors for this department. Indo-Europeans are £2 up: Anglo-Americans show modest gains. Foreign telephones are equally good. United River Plates have put on 6s. 3d.: Chile and Cuba shares, while nominally unchanged, are not easy to buy. Marconis have become quiescent. Canadian Marconis are easier at 6s. 9d. Burndept Wireless maintain their strength, the preferred at 24s., the deferred at 5s. 9d. Anglo-Portuguese Telephones have gone up to 15s. and are still wanted.

Aluminium Corporation shares dropped to 30 upon news of the deplorable disaster in North Wales. The accident caused a melancholy death-roll, and considerable damage to the company's property. The Aluminium Corporation supplies the North Wales Power Company with energy, and the latter has been steadily increasing its demands. Lancashire Light and Power ordinary are 1s. up at 26s. 6d. Electric Supply Corporation hardened to 32s. 6d. Bournemouth and Poole ordinary have again reached 3.

London electricity prices are hard. St. James' and Pall Mall have risen to 15; County new preference to 2s. 3d. premium buyers. There are on offer 1,000 Westminsters at 44s. 6d., 500 Charing Cross at 50s. 6d., and 500 City "Lights" at 46s. 9d.

Southern Brazil Electric bonds have been so freely "tipped" for some time past that widespread disappointment is felt at the accounts for 1924, showing a deficiency after payment of the debenture interest. The report states that the outlook is now brighter, owing to the improvement in the exchange, &c. The price of the bonds is about 54. British Columbia Electric Railway stocks are irregular, a rise of 2 in the preferred being balanced by a decline of similar amount in the deferred. Anglo-Argentine first preference have hardened to 3 7/16. The Mexican group affords no feature of interest.

The Madras Electric Supply interim dividend of 2½ per cent., tax free, is at the same rate as that of last year and the price of the shares remains at 24s. 6d. The company's 5½ per cent. preferred shares stand at 20s. and the 7 per cent. second debentures at 101½. Cawnpore Electric's interim dividend of 3 per cent. is less tax, as before; the ordinary are quoted at 25s., the 7 per cent. preference at a guinea and the 5 per cent. tax-free debentures at 95s. 2d. Brazilian Tractions have regained the deducted dividend of a dollar, at 80.

Home Railway steam stocks are depressed by the opposition offered to wage-reductions, on the part of the N.U.R. The Undergrounds have not been affected: Metropolitan Consols dated is a point higher on the week, and the rest of the list is unchanged. The general volume of business throughout Stock Exchange markets shows appreciable diminution from the high tide it reached last month, and everyone who benefited from the rush is thankful for the breathing space that the bull provides.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923.	1924.	Price Nov. 9. 1925.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	13	14	3	+ 1/6	4 13 4
Brompton Ordinary	1	10	10	1½	—	*5 14 8
Charing Cross Ordinary	1	14½	15	£0/-	—	6 2 5
do. do. 4½ Pref....	1	4½	4½	17/6	—	5 2 10
Chelsea	1	13	13	1⅞	—	6 8 0
City of London	1	15	15	47/-	—	6 7 4
do. do. 5% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	27/6	—	5 16 4
County of London	1	15	15	57/-	—	5 5 2
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	7	22/6	+7½d.	6 4 5
do. 7% Pref.	1	6	7	21/6	—	6 10 8
Elec. Supply Corporation ...	1	10	10	22/6	+1/-	6 8 0
Kensington Ordinary	5	14	15	12½	—	5 16 8
Lancs. Light and Power	1	7½	7½	26/6	+1/-	5 13 2
London Electric	1	10	10	34/-	—	5 17 8
do. do. 6% Pref.... ...	5	6	6	5⅝	—	5 6 8
Metropolitan	1	10	11	38/6	—	5 14 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	22/3	—	5 7 10
Newcastle-on-Tyne Ordinary ...	1	6	7	22/6	—	6 4 5
do. 5% Pref. ...	1	5	5	18/9	—	5 5 8
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref. ...	1	6	6	22/6xd	+6d.	5 6 8
St. James' and Pall Mall	5	17½	17½	15	+ ¼	5 16 8
South London	1	15	15	2⅞	—	5 17 1
South Metropolitan Pref. ...	1	7	7	1½	—	5 12 0
Urban Ordinary	1	4	4	18/3	—	4 7 8
do. 6% Pref. ...	1	6	6	18/9	—	6 8 1
Westminster Ordinary	1	15	15	44/6	—	6 14 10
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	—	7 10 0
Yorkshire Elec.	1	8	8	29/6	—	5 8 6

HOME RAILS.

Central London Ord. Assented	Stock	4	4	67	—	5 19 5
Metropolitan	,,	4	5	71	+1	7 0 10
do. District	,,	3½	3½	46	—	7 12 1
Underground Electric Ordinary	10	Nil	Nil	2½	—	Nil
do. do. "A" ...	1/-	Nil	Nil	7/-	—	Nil
do. do. Income	Bonds	6	6	97	—	*6 3 9

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103	+1	5 16 6
do. Def.	,,	1½	1½	24⅜	+ ¼	6 3 1
Automatic Telephone	1	3	6	2½	+ ¼	2 8 7
Chili Telephone	5	6	5	6⅞	—	*4 7 0
Cuba Sub. Ord.	10	5	5	6⅞	—	7 8 2
Eastern Extension	10	10	10	18	+ ½	*5 11 1
Eastern Tel. Ord.	Stock	10	10	178½	+4	*5 12 1
Globe Tel. and T. Ord.	10	10	10	18½	+ ½	*5 9 7
do. do. Pref.	10	6	6	11	—	5 8 1
Great Northern Tel.	10	22	22	35	—	6 5 9
Indo-European	25	7	8½	45½	+2	*4 13 5
Marconi	1	10	10	1⅜	—	7 5 6
Marconi Marine	1	10	7½	⅞	—	8 11 6
Oriental Telephone Ord. ...	1	12	12	2½	—	*5 13 4
United R. Plate Tel.	5	8	8	7⅜	+ 1/8	5 5 6
Western Telegraph	10	10	10	17½	+ ½	*5 16 0

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅞	+ 1/8	8 0 0
do. do. 2nd Pref. ...	5	6	6	3⅜	—	8 17 10
do. do. 5% Deb. ...	Stock	5	5	78½	—	6 7 5
British Electric Traction Ord. ...	,,	6	6	139½	—	4 17 2
do. do. 6% Pref. ...	,,	6	6	107	—	5 12 2
Brazil Traction	100	4	4	80xd	+1	5 0 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	96/-	96/-	98½	+2	*4 17 6
do. do. Deferred	,,	129/5	129/5	116½	—2	*5 11 0
do. do. Deb.	,,	4½	4½	77½	—	5 9 8
Lond. & Sub. Trac. 5% Pref. ...	1	2½	Nil	4/6	—	Nil
London United Tram. Deb. ...	Stock	4	4	42½	—	9 8
Mexico Trams, 5% Bonds ...	—	5	5	63½	—	7 17 6
Mexican Light Common ...	100	Nil	Nil	32	—	Nil
do. Pref.	100	Nil	Nil	64	+ ½	Nil
do. 1st Bonds ...	—	5	5	70½	—	7 1 11
Yorkshire (West Riding) ...	1	5	—	18/9	—	5 6 8

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	12	2⅝	—1/9	*4 13 7
British Aluminium Ord.	1	5	10	1⅜	—	5 6 8
British Elec. Transformer Pref.	1	Nil	7	1	—	... ...
British Insulated Ord.	1	15	15	3½	—	4 0 0
Brush Ord.	1	10	10	24/6	—	8 3 5
Callenders	1	15	15	8⅜	—	4 9 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	⅜	—	... ...
Edison-Swan	4/-	10	10	9/-	—3d.	4 9 0
do. 5% Deb.	Stock	5	5	84	+ ½	5 19 1
Electric Construction	1	10	10	1⅛	+ 1/16	5 18 6
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	19/3	+6d.	5 4 8
do. do. Pref.	1	6	6	21/-	+ 6d.	5 14 3
Gen. Elec. Pref.	1	6½	6½	23/9	—	5 9 5
do. Ord.	1	5	7½	28/6	—6d.	5 5 3
Henley	1	15	16	3⅞	—	4 10 5
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1⅛	+2/-	*4 9 0
Johnson & Phillips	1	10	10	59/3	+1/6	3 7 7
Met-Vickers, Ord.	1	8	8	25/-	+6d.	6 8 0
do. Pref.	2	6	6	2⅜	—	6 14 9
Siemens Ord.	1	—	7½	35/6	+3/6	4 4 6
Telegraph Construction	12	20	20	26½	—	4 10 0

* Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances

CHEMICALS, &c.	Price November 10th.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	6¾d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4¼d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Commercial ... ... ,,	£8 10s.	...
a ,, Roll ... ... ,,	£8 10s.	...
a Soda, Chlorate ... ... per lb.	2¾d. to 3¼d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£120 to £125	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£250	£5 dec.
Grade II ... ... ,, ,,	£178	£4 dec.
Grade III ... ... ,, ,,	£99	£3 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	10¼d.	...
c ,, Tubes (solid drawn) ... ,,	1/- to 1/0½	...
c ,, Wire, basis ... ... ,,	10¾d.	...
c Copper Tubes (solid drawn) ... ,,	1/1½	...
c ,, Bars (best selected) ... per ton	£92	...
c ,, Sheet ... ... ,,	£92	...
c ,, Rod ... ... ,,	£92	...
d ,, (Electrolytic) Bars ... ,,	£69 5s.	£5 dec.
d ,, ,, Sheets ... ,,	£148 10s.	...
d ,, ,, Wire Rods ... ,,	£78 5s.	5s. dec.
d ,, ,, H.C. Wire per lb.	9½d.	½d. inc.
f Ebonite Rod ... ... ,,	2/3 to 2/4	...
f ,, Sheet ... ... ,,	2 3to 2/6	...
a German Silver Wire ... ... ,,	2/8	...
h Gutta-percha, fine ... ... ,,	2/9	...
h India-rubber, Para fine ... ... ,,	3/9½	½d. inc
l Iron Pig (Cleveland Warrants) ... per ton.	nom.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English Pig ... ... ,,	£38 15s.	£2 dec.
g Mercury ... ... per bot.	£14 7s. 6d. to £14 10s.	10s. inc.
e Mica (in original cases) small ... per lb.	8d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/8	...
p ,, ,, rolled strip & sheet ,,	1/3½	...
p ,, ,, wire ... ... ,,	1/3½	...
o Platinum ... ... per oz.	£26	...
d Silicium Bronze Wire ... ... per lb.	1/0½	...
r Steel, Magnet, in bars ... ... ,,	7½d.	...
a Tin, Block (English) ... ... per ton.	£280 to £280 5s.	£5 to £5 5s. dec.
s Wire, Nos. 1 to 16 ... ... per lb.	4/1	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
a P. Ormiston & Sons.
e Johnson, Matthey & Co., Ltd.
e C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Educational.—UNIVERSITY OF LONDON, UNIVERSITY COLLEGE.—We have received a copy of the calendar for the current session, a volume of clxxviii+458 pages, which contains a vast amount of information regarding the College itself and the various Faculties, courses of study, scholarships, societies, &c., which are associated with it. Prof. E. G. Coker, F.R.S., is the Dean of the Faculty of Engineering, Prof. J. A. Fleming, F.R.S., Vice-Dean, and Mr. W. C. Clinton, B.Sc., Sub-Dean.

Transparent Steel.—A new method of making sheets of metal of unprecedented thinness, invented by Dr. Karl Müller, of the Physical Technical Institute of Berlin, seems likely to prove of considerable industrial as well as scientific importance. He has succeeded in producing sheets of steel so thin that they are as transparent as the clearest glass. The structure of the film is perfectly even and equal in all directions. The metal sheets are so thin that atoms will pass through them without impediment. Alpha rays from radium, which consist of streams of the stripped atoms of helium, and are completely blocked by a sheet of paper, are not perceptibly weakened in passing through such metal sheets. It is calculated from the specific gravity of the metal that these sheets are not more than thirty layers of atoms in thickness. Dr. Müller makes them by depositing an extremely fine film of the metal on a smooth surface by means of an electric current and afterwards separating the film from the foundation on which it was fixed. They seem likely to prove serviceable in metallurgical research, and in the making of galvanometers, radio receivers and apparatus for measuring the action of the heart.—*Science Supplement.*

United States Electrical Exports.

THE following figures, showing the exports of electrical machinery and apparatus from the United States and the principal countries of destination in 1924, are taken from the recently-issued annual statistics of American trade. The comparative figures for 1923 have been added and notes of any increases or decreases given.

According to the official statistics the total values in thousands of dollars of the exports of electrical machinery and apparatus since 1910 have been as follows:—

Av. 1910-14	...	21,094	...	1921	88,931
Av. 1915-19	...	41,317	...	1922	53,147
				1923	59,927
1920	...	93,184	...	1924	69,828

Insulated wires and cables, although shown below, are not classed in the United States statistics as electrical goods.

	1923. $	1924. $	Inc. or dec. $
Generators, d.c., under 500 kW—			
Total	788,000	1,067,000	+ 279,000
To France	62,000	149,000	+ 87,000
,, Canada	258,000	273,000	+ 15,000
,, Mexico	57,000	100,000	+ 43,000
,, Columbia	26,000	36,000	+ 10,000
,, Venezuela	14,000	18,000	+ 4,000
,, China	21,000	14,000	– 7,000
,, Japan	38,000	77,000	+ 39,000
,, Australia	31,000	40,000	+ 9,000
,, Cuba	33,000	68,000	+ 35,000
Generators, d.c., 500 kW and over—			
Total	753,000	850,000	+ 97,000
To Spain	31,000	—	– 31,000
,, Canada	39,000	45,000	+ 6,000
,, Cuba	128,000	42,000	– 86,000
,, Brazil	29,000	24,000	– 5,000
,, Chile	12,000	67,000	+ 55,000
,, China	23,000	—	– 23,000
,, Japan	163,000	159,000	– 4,000
,, Italy	—	53,000	+ 53,000
,, Mexico	63,000	161,000	+ 98,000
,, Dutch East Indies ...	2,000	50,000	+ 48,000
,, Philippine Islands ...	30,000	56,000	+ 26,000
Generators, a.c., under 2,000 kW—			
Total	127,000	169,000	+ 42,000
To Canada	17,000	26,000	+ 9,000
,, Mexico	4,000	9,000	+ 5,000
,, Argentina	8,000	—	– 8,000
,, Colombia	14,000	15,000	+ 1,000
,, Cuba	11,000	23,000	+ 12,000
,, Japan	12,000	30,000	+ 18,000
Generators, a.c., 2,000 kW and over—			
Total	1,284,000	1,157,000	– 127,000
To Italy	—	34,000	+ 34,000
,, Spain	19,000	54,000	+ 35,000
,, Canada	2,000	27,000	+ 25,000
,, Mexico	2,000	26,000	+ 24,000
,, Cuba	22,000	23,000	+ 1,000
,, Brazil	44,000	3,000	– 41,000
,, China	95,000	20,000	– 75,000
,, Japan	817,000	843,000	+ 26,000
,, India	124,000	71,000	– 53,000
Steam turbine generator sets—			
Total	*	75,000	—
To Mexico	—	23,000	—
,, Cuba	—	26,000	—
Accessories and parts for generators—			
Total	1,025,000	1,270,000	+ 145,000
Self-contained lighting outfits—			
Total	610,000	780,000	+ 170,000
To Spain	25,000	17,000	– 8,000
,, Great Britain	61,000	83,000	+ 22,000
,, Mexico	41,000	23,000	– 18,000
,, Argentina	62,000	140,000	+ 78,000
,, Colombia	14,000	7,000	– 7,000
,, Cuba	49,000	52,000	+ 3,000
,, Uruguay	14,000	45,000	+ 31,000
,, India	2,000	5,000	+ 3,000
,, Australia	142,000	144,000	+ 2,000
,, British South Africa ...	38,000	42,000	+ 4,000
Power transformers—			
Total	3,195,000	3,286,000	+ 91,000
To Cuba	54,000	260,000	+ 206,000
,, France	516,000	26,000	– 490,000
,, Canada	45,000	46,000	+ 1,000
,, Mexico	104,000	224,000	+ 120,000
,, Brazil	188,000	204,000	+ 16,000
,, Chile	112,000	67,000	– 45,000
,, India	62,000	62,000	—
,, China	112,000	8,000	– 104,000
,, Japan	1,490,000	1,696,000	+ 206,000
,, Australia	42,000	40,000	– 2,000
,, Spain	116,000	65,000	– 51,000
Other transformers—			
Total	760,000	2,368,000	+1,608,000
Rectifiers, double current, and motor generators, dynamotors, synchronous and other converters—			
Total	999,000	1,157,000	+ 158,000
To France	318,000	206,000	– 112,000
,, Great Britain	41,000	53,000	+ 12,000
,, Canada	116,000	146,000	+ 30,000
,, Mexico	30,000	37,000	+ 7,000
,, Chile	11,000	13,000	+ 2,000
,, Uruguay	5,000	2,000	– 3,000
,, India	45,000	22,000	– 23,000
,, Japan	171,000	347,000	+ 176,000
,, Australia	33,000	54,000	+ 21,000
,, Spain	30,000	43,000	+ 13,000
,, Brazil	42,000	79,000	+ 37,000
Switchboard panels, except telephone—			
Total	1,668,000	2,163,000	+ 495,000
Switches and circuit breakers over 10 amps.—			
Total	1,796,000	2,245,000	+ 449,000
Fuses and fuse blocks—			
Total	311,000	282,000	– 29,000
Watt-hour and other measuring instruments—			
Total	519,000	624,000	+ 105,000
To Canada	94,000	44,000	– 50,000
,, Mexico	59,000	55,000	– 4,000
,, Cuba	71,000	65,000	– 6,000
,, Brazil	50,000	100,000	+ 50,000
,, China	48,000	57,000	+ 9,000
,, Japan	56,000	183,000	+ 127,000
Volt, watt-, ampere-, and other recording, &c., apparatus—			
Total	1,027,000	1,367,000	+ 340,000
Lightning arresters, choke coils, &c.—			
Total	616,000	920,000	+ 304,000
Motors, under 1 h.p.—			
Total	1,728,000	1,687,000	– 41,000
To Holland	15,000	32,000	+ 17,000
,, Spain	64,000	42,000	– 22,000
,, Great Britain	647,000	286,000	– 361,000
,, New Zealand	47,000	36,000	– 11,000
,, Canada	459,000	537,000	+ 78,000
,, Mexico	21,000	30,000	+ 9,000
,, Argentina	25,000	41,000	+ 16,000
,, Japan	98,000	194,000	+ 96,000
,, Australia	84,000	101,000	+ 17,000
Stationary motors, 1 to 200 h.p.—			
Total	3,088,000	2,392,000	– 696,000
To Spain	106,000	93,000	– 13,000
,, Great Britain	132,000	88,000	– 44,000
,, Canada	562,000	428,000	– 134,000
,, Mexico	155,000	199,000	+ 44,000
,, Cuba	121,000	144,000	+ 23,000
,, Brazil	65,000	70,000	+ 5,000
,, Chile	46,000	77,000	+ 31,000
,, China	92,000	36,000	– 56,000
,, Japan	454,000	383,000	– 71,000
,, Australia	406,000	172,000	– 234,000
,, British South Africa ...	157,000	81,000	– 76,000
Railway motors—			
Total	660,000	1,328,000	+ 668,000
To Canada	12,000	25,000	+ 13,000
,, France	26,000	307,000	+ 281,000
,, Spain	4,000	201,000	+ 197,000
,, Mexico	27,000	245,000	+ 218,000
,, Brazil	66,000	117,000	+ 51,000
,, Chile	136,000	—	– 136,000
,, Japan	249,000	82,000	– 167,000
Motors, over 200 h.p.—			
Total	813,000	576,000	– 237,000
To Mexico	32,000	44,000	+ 12,000
,, Chile	74,000	65,000	– 9,000
,, Japan	46,000	126,000	+ 80,000
,, British S. Africa	43,000	21,000	– 22,000
Starting and controlling equipment—			
Total	1,752,000	1,536,000	– 216,000
For industrial motors ...	*	1,429,000	—
For electric railway and vehicle motors	*	107,000	—
Accessories and parts for motors—			
Total	1,659,000	1,998,000	+ 339,000
Railway signals, switches, and attachments—			
Total	734,000	964,000	+ 230,000
To Canada	213,000	160,000	– 53,000
,, Japan	185,000	109,000	– 76,000

* Not separately distinguished.

	1923. $	1924. $	Inc. or dec. $
Insulating material—			
Total	1,436,000	1,536,000	+ 100,000
To France	60,000	58,000	– 2,000
,, Great Britain	345,000	492,000	+ 147,000
,, Canada	357,000	254,000	– 103,000
,, Japan	241,000	199,000	– 42,000
,, Australia	56,000	65,000	+ 9,000
Fans—			
Total	859,000	1,028,000	+ 169,000
To Canada	60,000	51,000	– 9,000
,, Argentina	66,000	61,000	– 5,000
,, China	169,000	76,000	– 93,000
,, British India	136,000	59,000	– 77,000
,, Australia	60,000	54,000	– 6,000
,, Cuba	21,000	71,000	+ 50,000
,, Mexico	47,000	68,000	+ 21,000
,, Great Britain	86,000	58,000	– 28,000
,, Japan	39,000	272,000	+ 233,000
,, Hong-Kong	51,000	93,000	+ 42,000
Heating and cooking apparatus—			
Total	984,000	1,104,000	+ 120,000
To Norway	6,000	6,000	—
,, Great Britain	128,000	114,000	– 14,000
,, Canada	224,000	235,000	+ 11,000
,, Japan	59,000	127,000	+ 68,000
,, Argentina	44,000	54,000	+ 10,000
,, Australia	199,000	176,000	– 23,000
,, Mexico	46,000	63,000	+ 17,000
,, Brazil	10,000	13,000	+ 3,000
Motor-driven household devices—			
Total	866,000	888,000	+ 22,000
To Holland	79,000	100,000	+ 21,000
,, Great Britain	265,000	303,000	+ 38,000
,, Canada	144,000	151,000	+ 7,000
,, Japan	15,000	22,000	+ 7,000
,, Australia	101,000	59,000	– 42,000
,, Belgium	76,000	67,000	– 9,000
Industrial electric furnaces and ovens—			
Total	214,000	240,000	+ 26,000
Metal filament lamps—			
Total	1,131,000	1,070,000	– 61,000
To Canada	37,000	70,000	+ 33,000
,, Peru	21,000	31,000	+ 10,000
,, Mexico	255,000	171,000	– 84,000
,, Cuba	185,000	183,000	– 2,000
,, Argentina	95,000	98,000	+ 3,000
,, Brazil	22,000	30,000	+ 8,000
,, Australia	101,000	130,000	+ 29,000
,, British South Africa ...	49,000	38,000	– 11,000
,, Chile	57,000	48,000	– 9,000
Magnetos, spark plugs, &c.—			
Total	1,695,000	1,911,000	+ 216,000
To Italy	26,000	82,000	+ 56,000
,, Great Britain	50,000	113,000	+ 63,000
,, Canada	616,000	443,000	– 173,000
,, Argentina	90,000	95,000	+ 5,000
,, India	12,000	23,000	+ 11,000
,, Japan	117,000	151,000	+ 34,000
,, Australia	93,000	68,000	– 25,000
,, New Zealand	24,000	31,000	+ 7,000
,, British South Africa ...	12,000	18,000	+ 6,000
,, Mexico	29,000	34,000	+ 5,000
Insulated wire and cable, iron or steel—			
Total	687,000	398,000	– 289,000
To Canada	17,000	11,000	– 6,000
,, Mexico	95,000	60,000	– 35,000
,, Cuba	122,000	45,000	– 77,000
,, Brazil	18,000	11,000	– 7,000
,, Japan	95,000	4,000	– 91,000
,, Venezuela	6,000	34,000	+ 28,000
,, Philippine Islands ...	36,000	37,000	+ 1,000
Insulated wire and cable, copper—			
Total	3,140,000	3,896,000	+ 756,000
To Great Britain	274,000	456,000	+ 182,000
,, Canada	404,000	405,000	+ 1,000
,, Mexico	414,000	306,000	– 108,000
,, Cuba	502,000	942,000	+ 440,000
,, Brazil	306,000	360,000	+ 54,000
,, Chile	121,000	267,000	+ 146,000
,, China	59,000	36,000	– 23,000
,, Japan	168,000	35,000	– 133,000
,, Philippine Islands ...	72,000	169,000	+ 97,000
,, Australia	34,000	101,000	+ 67,000
,, Colombia	66,000	86,000	+ 20,000
,, New Zealand	27,000	68,000	+ 41,000
Batteries, storage—			
Total	2,344,000	2,883,000	+ 539,000
To Denmark	118,000	135,000	+ 17,000
,, France	59,000	8,000	– 51,000
,, Great Britain	202,000	197,000	– 5,000
,, Canada	220,000	327,000	+ 107,000
,, Mexico	111,000	99,000	– 12,000
,, Argentina	255,000	348,000	+ 93,000
,, Brazil	92,000	225,000	+ 133,000
,, India	57,000	117,000	+ 60,000
,, Australia	235,000	238,000	+ 3,000

	1923. $	1924. $	Inc. or dec. $
Batteries, primary—			
Total	1,273,000	1,711,000	+ 438,000
To Norway	15,000	8,000	– 7,000
,, Great Britain	24,000	83,000	+ 59,000
,, Canada	18,000	18,000	—
,, Argentina	310,000	327,000	+ 17,000
,, Chile	22,000	35,000	+ 13,000
,, China	29,000	37,000	+ 8,000
,, Australia	71,000	103,000	+ 32,000
,, New Zealand	87,000	102,000	+ 15,000
,, British India	42,000	86,000	+ 44,000
,, Brazil	27,000	56,000	+ 29,000
,, Mexico	158,000	234,000	+ 76,000
,, Spain	13,000	22,000	+ 9,000
Metal conduit, outlet and switch boxes—			
Total	478,000	574,000	+ 96,000
Sundry wiring supplies and fixtures—			
Total	1,891,000	1,149,000	– 742,000
Telegraph apparatus—			
Total	1,891,000	516,000	–1,375,000
To Great Britain	66,000	43,000	– 23,000
,, Cuba	20,000	15,000	– 5,000
,, Canada	87,000	156,000	+ 69,000
,, Japan	66,000	140,000	+ 74,000
,, Argentina	362,000	5,000	– 357,000
Radio apparatus—			
Total	3,448,000	6,031,000	+2,583,000
To Poland	11,000	6,000	– 5,000
,, Great Britain	200,000	142,000	– 58,000
,, Canada	796,000	2,414,000	+1,618,000
,, Argentina	647,000	292,000	– 355,000
,, Cuba	212,000	103,000	– 109,000
,, Mexico	281,000	394,000	+ 113,000
,, Sweden	459,000	132,000	– 327,000
,, Australia	210,000	1,053,000	+ 843,000
Telephones, magneto—			
Total	196,000	183,000	– 13,000
To Great Britain	11,000	1,000	– 10,000
,, Canada	44,000	6,000	– 38,000
,, Cuba	42,000	23,000	– 19,000
,, Colombia	14,000	9,000	– 5,000
,, Australia	18,000	41,000	+ 23,000
,, Brazil	4,000	25,000	+ 21,000
Telephones, other—			
Total	406,000	543,000	+ 137,000
To Canada	85,000	112,000	+ 27,000
,, Mexico	10,000	17,000	+ 7,000
,, Cuba	34,000	41,000	+ 7,000
,, Brazil	76,000	39,000	– 37,000
,, Australia	71,000	91,000	+ 20,000
,, New Zealand	47,000	5,000	– 42,000
Magneto switchboards—			
Total	119,000	14,000	– 105,000
Other telephone switchboards—			
Total	403,000	1,147,000	+ 744,000
Locomotives, electric railway—			
Total	3,037,000	1,923,000	–1,114,000
To France	224,000	14,000	– 210,000
,, Spain	484,000	—	– 484,000
,, Chile	2,092,000	—	–2,092,000
,, Japan	118,000	167,000	+ 49,000
,, Mexico	4,000	1,425,000	+1,421,000
,, Brazil	66,000	268,000	+ 202,000
Locomotives, electric, mining and industrial—			
Total	277,000	320,000	+ 43,000
To Chile	34,000	45,000	+ 11,000
,, Japan	147,000	62,000	– 85,000
,, Mexico	47,000	27,000	– 20,000
,, Australia	—	22,000	+ 22,000
,, British South Africa ...	22,000	68,000	+ 46,000
,, Canada	7,000	33,000	+ 26,000

A Patent Law for the Straits Settlements.—By a recent amendment to Sections 14 and 15 of the Straits Settlements Ordinance, it is now possible for British patentees to obtain protection in the Straits Settlements corresponding to their British patents. Messrs. Hughes & Young, Patent Agents, state that a patent can be registered in the Colony by applying within three years from the date of the issue of the British patent, the application, if the British patent is assigned, being made by the assignee. Normally, the patent expires with the expiration of the corresponding British patent, but applications for extension of the term of the patent can be lodged before the last three years of the full duration of the British patent. The Act provides against any action for infringement which occurred before the issue of the certificate or registration in the Colony, although the registration has a priority date corresponding to the date of the British patent. The Federated Malay States and Johore have introduced similar amendments in their Patent Laws.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

An Aerial Protector.

Considering the number of broadcast radio-telephone receivers now in use, the instances which have been reported of such apparatus having been damaged by lightning striking the aerials are remarkably few. The extent to which an aerial may be affected by a lightning discharge and the results likely to arise therefrom are of practical importance, and the subject is now receiving more attention than hitherto.

For the benefit of those users of outdoor aerials who consider it desirable to provide some form of protection against the risk of fire or damage to the receiving apparatus which may arise in the above-mentioned way (remote though the risk is), MESSRS. SIEMENS BROS. & CO., LTD., have developed what would appear to be an efficient protector. This compact

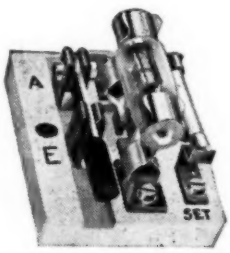


Fig. 1.—A Siemens Aerial Protector.

little device embodies the firm's well-known vacuum arrester, a fuse, and an earthing switch all mounted on a porcelain base, as shown in fig. 1. It has the advantage of ensuring protection at all times, whether the set is in use or not, and it is capable of functioning many times before renewal becomes necessary. Simpler types of both vacuum and carbon-block arresters, but without earthing switches, are available, and the company also supplies porcelain-base fuses for protectiag l.p. and h.p. batteries in the event of a short circuit.

The "Protex" Fuse.

Another accumulator safety device is shown in figs. 2 and 3; it is a simple attachment, a product of Messrs. WARD & GOLDSTONE, LTD., capable of being fitted in a few seconds, and consists of suitable terminals to hold the fuse wire, mounted in a channel which protects the instrument panel in the case of the fuse blowing. A supply of fuse wire is provided with each "Protex," which may be used for protection against short

Figs. 2 & 3.—"Protex" Accumulator Fuses.

circuit or over-charging of the accumulator, or (with finer fuse wire) in circuit with the valves, or as an ordinary fuse, &c. The simplest method of attachment is to place the slotted end of the fuse under the battery terminal, the circuit being continued from the terminal at the opposite end of the "Protex"; for bridging two accumulator cells two slotted connector plates are provided, as shown above.

The "Goltone" Receptor.

In order to obviate the use of loading coils for tuning-in the Daventry station (1,600 m.) on "short-wave" crystal sets, the receptor shown in fig. 4 has been placed on the market by Messrs. WARD & GOLDSTONE, LTD. This device affords a simple method of adapting existing crystal sets, it being

Fig. 4.—"Goltone" Receptor.

a capacity device, complete in itself, and is connected across the aerial and earth terminals by means of the flexible cords shown in the illustration. On valve sets which do not employ high-frequency amplification, the "Goltone" receptor is said to permit the tuning-in of 5 XX.

A New Loud-speaker.

The design of the BRITISH THOMSON-HOUSTON CO.'s new type C2 loud-speaker has been given careful attention, as is indicated in figs. 5 and 6. The body containing the whole magnetic pole-piece assembly is embedded in Fabrolite, a synthetic moulded insulating compound having high insulating properties. This construction ensures rigidity and freedom from vibration, as the number of separate parts is reduced to a minimum. The diaphragm is clamped rigidly at its periphery by means of moulded threads on the body and base, which are both made of Fabrolite. The small end of the horn is held rigidly in position by means of a nut which co-operates with an internal thread moulded in the base. Permanent cobalt-steel magnets are used in the magnetic circuit, which is

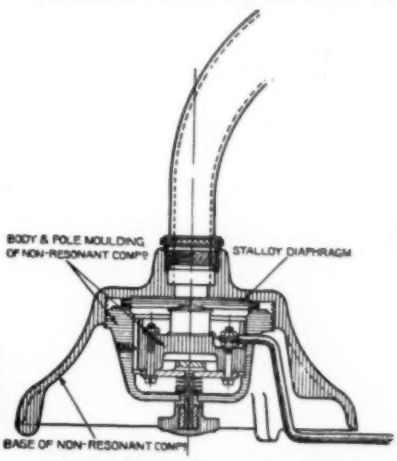


Fig. 5.—Section Through Base of B.T.-H. "C2" Loud-speaker.

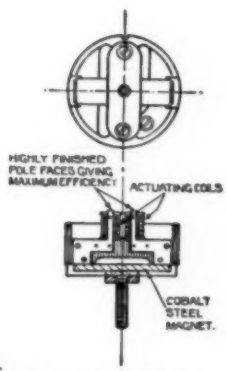


Fig. 6.—Plan and Elevation of "C2" B.T.-H. Loud-speaker.

short and direct so as to produce a field of high intensity, and a special construction is adopted to secure good contact between the pole pieces and the ends of the magnet. The magnetic field of each pole piece is measured on each unit to ensure that a certain intensity is produced, and the spools are very thin, so that the turns of wire, being very close to the magnet, exert the maximum effect. Each and every coil is tested to ensure uniformity, and the flexible lead is attached to terminals inside the magnetic unit. The moulded base and the flare of the horn are of the usual B.T.-H. chocolate brown, while the neck is polished aluminium, the appearance being enhanced by a decorative grille in the mouth of the horn.

The Hanging "Mellovox" Loud Speaker.

The hornless loud-speaker shows a tendency to become the most popular model of the season, and in order to meet further public requirements the hanging "Mellovox" has been introduced to meet the wishes of those who prefer a loud-speaker which can be hung in any part of a room. We are informed by the MARCONIPHONE CO., LTD., that the general constructional

Fig. 7.—Hanging "Mellovox" Loud-speaker.

details are identical to those of the ordinary type of "Mellovox," with the exception that the base has been removed and a ring attached to the adjustment screw as a means of suspension, see fig. 7. A lead, 16 ft. long, has been fitted in order that the loud-speaker may be placed in any position of advantage within reasonable distance of the set. Regarding performance, a full rich tone is maintained, with sufficient volume to meet the requirements of the listener, and the instrument gives less directional effect than is usually experienced in most loud speakers.

The Electrical Trades Benevolent Institution.

Annual Festival Dinner.

YET another successful annual festival of the E.T.B.I. has to be recorded to the credit of those responsible for the conduct of this very deserving organisation. It was held at the Trocadero Restaurant, London, on November 4th, when Mr. Edgar S. Barralet presided over some 150 members of the Institution and their ladies and guests—good support it might be thought, but why is it not an even bigger affair, especially as such good entertainment is the rule? Under the able hon. secretaryship of Mr. F. B. O. Hawes, the fund should be better supported in the provincial industrial centres. If employers would acquaint their staffs with the advantages of membership, common-sense would soon show what an extraordinary investment a modest annual subscription of 10s. is. The splendid yield, in case of necessity, to those who make themselves eligible needs to be brought more persistently before the notice of the rank and file. The insurance offered only needs to be known to be appreciated.

The CHAIRMAN proposed the "E.T.B.I.," and reminded his hearers that the electrical industry was one of the greatest and had a vast capital invested in it; numbers of people employed in it were afflicted with misfortune from time to time, and an Institution such as theirs was needed to take care of them. There were two ways of assisting the fund:—One was to subscribe that evening as liberally as they could, and the other was to do propaganda work elsewhere. It was very necessary that the inadequate pension fund should be built up to a reasonable figure, and it needed very little arithmetic to show how many subscribers at 10s. per annum would suffice to make that fund self-supporting.

Mr. F. G. KELLAWAY, in echoing the president's remarks, pointed out that he had been connected with the electrical industry for probably a shorter period than anyone in the room. Three years ago he was a politician pure and simple, and now he was a business man pure and simple—so far as business men were simple and pure. When his constituents tired of returning him to Parliament he looked round for something to do in an atmosphere of calm, naturally turning to the electrical industry, and again, naturally, to the Marconi Co. Everyone connected with the electrical industry must be very proud of it; the characteristics of Englishmen were shown no better than in the way the electrical industry had been built up. It had changed the character of the country. The country also had a right to be proud of the progress made in radio broadcasting, particularly on the technical side. Technically they had nothing to learn from other countries, but he was not so sure whether they were making the most of the business from the programme point of view. English people did not like a censorship, whatever form it might take, and he hoped that the Government Committee which was to consider the subject of broadcasting very shortly would take into serious consideration whether the present procedure with regard to programmes was best. He feared that it would not be so, so long as programmes were determined by one body alone. In supporting the fund, he remarked that the worst tragedies were not always found in mean streets and poor homes, but in the "black coat" classes, whose pride prompted them to maintain appearances regardless of cost. It was that class of poverty with which the Institution dealt, and it did so without allowing those helped to suffer in self-respect. One result of the war was that the people now were quicker to sympathise with the sufferings of others, and he asked all those present to express their feeling in a practical manner.

Mr. J. SNOW HUDDLESTON toasted the ladies, remarking that they did not often have that toast nowadays, but it was on the list that night because ladies were now eligible for membership and the benefits of the Institution. Amongst the ladies' duties the oldest was benevolence, and in that sphere they always surpassed mere man. With the toast he coupled the name of Mrs. A. J. Wilson, and hoped that the E.T.B.I. fund would in time be as adequate as the one for which she performed the secretarial duties.

Mrs. A. J. WILSON, secretary of the Motor Trades Benevolent Fund, in an excellent reply to the toast, said that not so long ago people would have been horrified to know that ladies had attended such a function, but she took it as a sign of grace that they had been invited that night. Born together about 1905, and both attaining their majority next year, the two funds had grown side by side, each hardly knowing that the other existed. In the case of the motor trade, the fund had met with amazing generosity, due to the large and active support of the rank and file of the trade, who, initially, were very hard to enrol as members. Gradually their efforts had borne fruit, and to-day the "black coats" formed the backbone of the fund. What was the good of employers giving generous donations if employés—the very people who would benefit—did not make themselves eligible? The royal road to success was undoubtedly live membership of the rank and file.

Mr. J. Y. FLETCHER (chairman, E.T.B.I. Committee) proposed the health of the chairman, and thanked him for coming forward and fulfilling the onerous duties of the chairman's post. He had not spoken with a gloomy face, but had departed from custom somewhat and had "varnished" his face into a smile and had been "pinching" money everywhere. In the past they had been able to assist every applicant, but many people would sooner starve than ask for assistance, and the Committee was very much more worried about ferreting out deserving cases than it was about granting help. The size of their funds compelled them to go slowly, and they had no adequate means of discovering deserving cases as they should have. He was not quite sure of the figures, but about five years ago the motor trade fund stood at something like £100,000, which fact was a reflection on the electrical industry. Some names appeared on the list of donors year after year, and others gave generously, but they had failed to enlist the active assistance of the rank and file. Those were the people who would actually benefit, and it was therefore obvious that they were the members required.

The CHAIRMAN, in his brief reply, announced that the amount collected this year was £1,326 15s. 2d., and there was more to come. The sum collected at the table was £161 17s. 6d.

Between the speeches the company was entertained to an excellent (thanks to the assistance of Major H. Clifford Palmer) selection of music and song.

The Salesman's Art.

Some Desirable Qualifications.

AT a meeting of the Electrical Trades Commercial Travellers' Association, at the E.L.M.A. Lighting Bureau, on October 30th, Mr. V. W. Dale, of the British Electrical Development Association, delivered an address containing a great deal of useful advice for electrical salesmen.

In his opening remarks Mr. Dale made the interesting statement that during the next year upwards of five million books, posters and leaflets would be circulated by his Association, each one going straight to the ultimate user.

The speaker stated that the salesman's task was to secure the utmost business from the largest number of customers at fair and economic prices. Efficient production was a great deal, but the creation of markets at home and overseas, and efficient selling, were equally as important. It was of no use producing more goods, even at a lower cost, unless the market for them was existent. If manufacturers founded a good organisation and produced satisfactory articles it was the duty of the salesmen to present in themselves as perfect a reflection of those meritorious conditions as they possibly could. The personal equipment of a salesman must include enthusiasm, optimism, courtesy, cheerfulness, sincerity, honesty, self-confidence, and good health. This looked a formidable list of virtues, but practically all of them were attainable by the right men. It was often debated whether salesmanship was a gift at birth or an acquired art; the principal element of successful salesmanship—self-confidence—most certainly had to be acquired.

A salesman's time was very valuable, and every available moment should be spent profitably. The speaker had heard of travellers who always drew up in advance a plan of the area which they intended to cover, marking it with railway stations, &c. It had to be borne in mind that customers' time was important, too; therefore, expositions and demonstrations should be brief, though thorough. Time could also be saved by definitely avoiding entirely and absolutely fruitless calls. A place should never be left until somebody had been seen, for generally the proprietor or the buyer had an assistant, to whom due respect should be given, for he might be the buyer or proprietor of the future.

An important part of the salesman's business was the revealing to the public of their needs, for in many directions, *e.g.*, lighting, the public were woefully ignorant concerning the full and proper usage. The average person could be told with regard to lighting that he needed extra lamps for the bed, the dressing table, &c., reading lights and better switch controls, and the same was true of small power and heating applications. When producing the influence of oral suggestion the salesman should not fall into the error of imagining that "highbrow facts" and sonorous words were necessary. More often than not something quite simple and human would provide the best starting point. It had to be remembered that when people bought electrical appliances they were really buying comfort, convenience, service and better health, and, moreover, something better than their neighbours and friends possessed. All these impulses and emotions were well worth studying and analysing, and countless avenues for the exploitation of fresh markets would be discovered as a result. Salesmen should keep themselves up to date with the whole of their principals' advertising, and should read very carefully at least one or two trade papers regularly, including a journal published by gas competitors.

A great deal of service could be rendered by salesmen to their trade customers; for instance, it was possible to convey suggestions for improving the attractiveness of windows, utilising showroom space to greater advantage, arranging periodical demonstrations, &c. This information should be imparted in a tactful manner so as not to cause the customer to feel that he did not know how to run his own business. It was necessary for a salesman to be adaptable, within reason, to the moods and peculiarities of his customers. Some buyers preferred familiarity; others did not. A sales manager should have an intimate knowledge of the temperaments of his out-door force, for it had been proved that men who

were the very best salesmen in one part of the country could be total failures in another district. A salesman could not afford to be over-sensitive; he certainly had to be long-suffering and able to keep his temper in the very difficult circumstances. In spite of every effort, failure was bound to come sometimes, for reasons known or unknown; the salesman could not afford to allow himself to be discouraged. In many cases failure could sometimes be more valuable than success, if only because a man did not waste his time bragging about it.

It was a great mistake for a salesman to load a customer with material when his expert knowledge of the peculiarities of the local demand distinctly pointed to the fact that a market for this material did not exist. Such over-selling came off only once, and the policy was fatal, both to the salesman and to the firm which he represented. Where, however, it was found that in spite of the existence of a market, retailers' shelves were still loaded with unsold goods, the retailer should be tactfully told that he was failing to make proper use of his opportunities, and he should be offered assistance. In investigating market possibilities the salesman should seek the aid of local directories, census returns, and supply undertaking records, and a visit should be paid to the Town Clerk's office. In this way a great deal of valuable information could be obtained to make prospective sale efforts much more clearly defined, promising far better results than could be obtained by working almost entirely in the dark.

In concluding his address, Mr. Dale said that there was every indication that an immense volume of business was waiting and would be obtained as soon as the country really settled down.

The Distribution of Electricity.

I.E.E. Discussion on Cost Reduction.

At the opening meeting of the Informal Meetings Section of the Institution of Electrical Engineers, Mr. R. A. Chattock took the chair and opened a discussion, in which some 15 speakers took part, on the subject of "How Can the Cost of Distribution be Cheapened?"

According to the official *résumé* of the proceedings, the president pointed out the facts that areas of supply were tending to become larger, and densely-populated districts were being extended to cater for residential demands situated at considerable distances. Existing methods of distribution were not applicable to these new areas, and rural districts were also being developed which required still different treatment. A comparison between the costs of the networks in Birmingham was as follows:—

	L.p., d.c.	*E.h.p., a.c.*
Total cost	£1,052,520	£408,790
kWh sold, year ending March 31st, 1925	60,200,000	100,735,740
Revenue from kWh sold ...	£546,838	£426,691
Annual return per £1 capital	10s. 5d.	£1 0s. 10d.

Most large towns had d.c. distributing networks fed from sub-stations and when the feeders supplying those networks became fully loaded it became necessary to lay additional feeders, or arrange to boost the pressure on the fringe of the networks by means of automatic converting plant. At a point in Birmingham 1,200 yards from a sub-station where the network was overloaded, the cost of a 1.0 sq. in. feeder cable, with additional rotary converter plant and switchgear in the main sub-station would amount to £9,400; the annual losses in conversion, boosting, and cables at ½d. per kWh amounted to £1,380; and the interest and sinking fund charges on the capital outlay at 8 per cent. amounted to £752; the total annual charge being £2,132.

The cost of an automatic 550-kW mercury-arc rectifier equipment with building would be £8,200; annual losses at ½d. per kWh would be £270; capital charges would be £660; and the total annual charge £930. The cost of an automatic 500-kW rotary converter equipment, with building, would be £6,500, and the total annual charges £790.

Another way of relieving the d.c. network was to transfer power consumers to the e.h.p. system. Hitherto, consumers of less than 100 h.p. had been connected to the d.c. system, but now that the e.h.p. mains covered practically the whole of the industrial section of the city, arrangements were being made to connect power users of 30 h.p. and upwards to the a.c. mains, and to employ a simple form of e.h.p. switchgear with a "tee" off the main. The saving in cost for a consumer 1,000 yards from the nearest source of supply and requiring 100 h.p. installed was as follows:—

	D.c.	*A.c.*
Capital cost of transforming plant and cable	£1,950	£1,040
Annual cost of maintenance losses and capital charges at 10 per cent. ...	£277	£140
If cables were available close to consumer's premises and a proportion of them was allocated for his load, the comparison was as follows:—	£157	£33

For an outlying residential district, a d.c. network fed by feeders from a central rotary-converter sub-station was not suitable, as the density of loading would not justify the expenditure. The cheapest form of distribution was a four-wire network fed by three-phase transformers with a pressure of 400 volts between phases.

For rural supplies, overhead distribution must be used, and a system must be designed as simply as possible with the details standardised. The Shropshire, Worcestershire, and Staffordshire E.P. Co. had developed a system for the large number of villages in its area, and the chief engineer, Mr. J. T. H. Legge, had furnished the following particulars:—

Overhead four-wire distributors were fed by transformers at frequent intervals, strung on poles. Wires strung in the same horizontal plane had a tendency to swing together, so they were placed vertically close to the poles, which arrangement enabled service wires to be taken off in a very simple manner and a cheap form of bracket to be standardised. Wires of different potential need never be crossed.

The cost of four-wire 0.05-sq. in. lines with an earthed neutral was as follows:—

Length of line.	*Cost per mile.*
2½ miles along roads	£399
1½ " " "	£411
Short lengths	£447
Poles in meadows.	
1 mile	£382
Short lengths	£395 to £448

The comparison between overhead and underground work was as follows:—

E.h.p. lines. *Size.*	*Cost per mile.* *Overhead.*	*Underground.*
3 × 0.1	£931	£1,804
3 × 0.06	£792	£1,628
L.p. lines.		
4 × 0.1	£572	£1,731

London and Home Counties Electricity District.

Inaugural Meeting of the Joint Electricity Authority.

On Wednesday, November 4th, the first meeting of the Joint Electricity Authority for the London and Home Counties Electricity District was held at the Institution of Electrical Engineers, London. Sir John Snell, G.B.E., chairman of the Electricity Commissioners, opened the proceedings as acting chairman, with a review of the history of electricity supply in London since the time, 20 years ago, when a Bill for the supply of the area was passed by both Houses of Parliament and only failed to become law by mischance. He had been concerned with the problem since 1905, in connection with the London County Council, and was familiar with the various schemes which had been put forward but had not matured. The District was provisionally determined by the Commissioners on July 17th, 1920, and local inquiries were held on the schemes submitted to them; the Order constituting the District and establishing the Joint Electricity Authority of 33 members was approved by Parliament and came into operation on July 29th, 1925, whilst the London Electricity Acts, Nos. 1 and 2, with which the scheme was closely bound up, became law two days later, empowering the company undertakers to amalgamate, extending their tenure till 1971, and making them subject to a sliding scale of price and dividend.

The area of the District was 1,785 square miles* and the population was nearly 8¼ millions; the assessable value was about £73,000,000. There were 43 local authority undertakers and 44 companies authorised to supply electricity in the District. The total capital expended on the electrical undertakings at the end of March last was £51,000,000. Since 1919-20 the maximum load (excluding traction) had grown from 320,000 to 535,000 kW, and the energy generated from 715 to 1,238 million kWh, an average growth of 15 per cent. per annum; the load factor remained at 26.7 per cent. Including the traction stations, the maximum load last year was 682,840 kW and the energy generated 1,950 million kWh, at a load factor of 35.8 per cent. In 15 years the load would probably be 1,682,000 kW and the output 4,000 million kWh.

It was clear that the Joint Electricity Authority would have duties involving great responsibilities. It would be able to assist the Commissioners in bringing about a reduction of the number of pressures and systems now extant and in simplyfying the tariffs in vogue; it would have to consider any unoccupied areas in the District with a view to providing a supply of electricity; it could borrow money up to a limit of £7,000,000, and issue stock. The Commissioners had always taken the view that in the performance of their own duties they must not be actuated by any other than technical considerations consistent with their legislative powers in seeking to secure for all an adequate supply of electricity at the lowest possible cost. He hoped that a similar objective with regard to the District would commend itself to the members of the Authority, and that all concerned would work together for the development of a great public utility service, and he concluded with an expression of appreciation of their public spirit in undertaking their great responsibilities.

Sir John Snell then invited nominations for the office of Chairman, and Ald. Vorley, J.P., of Islington, proposed the

* See page 764.—Eds.

name of Ald. Duncan Watson, J.P., M.I.E.E., as a man of outstanding ability, of wide municipal and administrative experience, a successful business man, and a technical man of high standing; he had been chairman of the Committee of Local Authorities for the past nine years, and it was largely due to his tact and experience that all parties were brought into accord. Sir HARRY RENWICK, K.B.E., cordially supported the proposal, remarking that amongst Mr. Duncan Watson's many qualities were personality, impartiality, and vision, which were most important for the post. Councillor ODELL, of Ilford, supporting the nomination, added to these qualities firmness and courage. There was no other nomination, and the motion was carried unanimously with enthusiasm.

On taking the chair, Mr. DUNCAN WATSON expressed his keen appreciation of the honour accorded him, and his sense of the great responsibilities imposed upon the Authority, whose duty it would be to place London in the van of electrical progress. In future all barriers must be swept aside, and all must work together in harmony. He would devote his whole energy to the maintenance of goodwill between all parties, to hasten the victory over inefficiency and retrogression.

The Authority then proceeded to deal with the agenda that awaited its attention. Major C. R. Attlee, M.P., vice-chairman of the Conference of Local Authorities, was elected as vice-chairman of the Authority, and Mr. Gardner, of the staff of St. Marylebone M.B.C., undertook the duties of temporary clerk, until a permanent official should be appointed.

MEMBERS OF THE JOINT ELECTRICITY AUTHORITY.

Appointing Bodies.	Members Appointed.
SECTION 1.	
Corporation of West Ham	Alderman G. Croot.
Company undertakers:—	
(1) Committee Company (10 companies)	Mr. W. F. Fladgate, M.V.O., J.P. (Charing Cross Co.).
(2) The Four Companies	Sir Harry Renwick, K.B.E. (County of London Co.).
County Councils:—	
(1) London County Council	Mr. A. Emil Davies; Mr. E. M. Dence; Sir G. Hume, M.P., J.P.; Mr. W. F. Marchant, O.B.E.; Mr. Herbert Morrison; Mr. R. C. Norman.
(2) Middlesex County Council.	
City of London Corporation	Mr. A. Thomas Snell, M.Inst.C.E., M.I.E.E.
Railway Companies Association	Lt.-Col. F. A. Cortez-Leigh, M.Inst.C.E., M.I.E.E., M.I.Mech.E (L.M. & S. Railway); Mr. Herbert Jones, M.I.E.E. (Southern Railway).
SECTION 2.	
Metropolitan Borough Councils	Alderman Major C. R. Attlee, M.A., M.P.; Alderman J. R. Chesterman; Councillor C. W. Key; Councillor B. J. Samels, L.C.C.; Councillor W. J. Stapleton; Alderman H. B. Vorley, J.P.; Alderman Duncan Watson, J.P., M.I.E.E.; Alderman T. Watt.
SECTION 3.	
Other Local Authority Undertakers	Councillor A. H. Dykes, M.Inst.C.E., M.I.E.E.; Alderman R. Moritz, K.C.; Councillor H. G. Odell; Alderman W. B. Robarts; Alderman Dudley Stuart, M.I.E.E.
SECTION 4.	
The Four Power Companies	Sir James Devonshire, K.B.E., M.I.E.E. (North Met. Co., &c.).
SECTION 5.	
Other Companies	Mr. K. A. Scott Moncrieff, M.I.E.E. (Hendon Electric Supply Co., &c.); Mr. P. D. Tuckett (Edmundsons, &c.).
SECTION 6.	
Other County Councils.	
SUPPLEMENTARY SECTION.	
Employés' Organisations	Mr. I. J. Hayward (National Union of Enginemen, Firemen and Electrical Workers); Mr. W. J. Webb (Electrical Trades Union).

Mines Department Testing Station.—Col. G. R. Lane-Fox, M.P., Secretary for Mines, announces that the Mines Department testing station will shortly be transferred from Eskmeals, Cumberland, to more convenient and accessible premises which are being fitted for the purpose at 42, Arundel Street, Sheffield. A short interruption of the official testing of safety lamps and electric bells and relays will occur during the erection of a new testing gallery and the removal of apparatus from Eskmeals, and manufacturers will assist the Mines Department if, so far as is possible, they will arrange to hold over until the New Year any testing work which is not put in the testing officer's hands by the middle of November. The other work of the testing station—including the analysis of mine air and mine dust samples—will, it is expected, be carried on without interruption.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Rural Electricity Supply.

I have been following, with much interest, the above correspondence, and whilst not proposing to enter the fray on the particular point at issue, I think it is to be regretted that Mr. Fennell has weakened his case by trying to side-track the matter on to the I.E.E. Regulations. It gives the impression that he felt he was losing his case and, like an astute lawyer, looked for some other point on which to fasten his argument.

Now it appears that Mr. Fennell, being very keen on rural development, finds two obstacles: (1) The Post Office, (2) the 1924 I.E.E. Regulations.

I only propose to deal with the latter, and would first of all refer Mr. Fennell to my article in the REVIEW of February 27th, wherein I pointed out that the Ontario Government is so anxious to develop the rural supply that it pays 50 per cent. of the cost of rural lines, but it nevertheless finds it necessary to enforce a higher standard for installation work than that of the I.E.E. Regulations. Experience has no doubt driven it to this necessity.

Then Mr. Fennell says he accepts the 1917 Edition, but not the 1924 Edition; the former contains 131 Rules and the latter 128, but a difference in the style of publication makes the 1924 Edition appear more formidable.

Mr. Fennell complains that the 1924 Edition is far too elaborate, but there, like all the other critics, he stops.

We can all put forward destructive criticism, but when it comes to sitting down and carefully thinking out something to replace that which is objected to, and which will not be open to other objections, then it is realised how difficult is the task.

When Mr. Fennell says he prefers the 1917 Edition to the 1924 Edition he is not fair to himself and has evidently not made a careful comparison between the two editions, or he would have realised that the last edition does allow greater latitude than the former editions.

I will quote one instance, *viz.*, "Testing." The 1924 Edition, as amplified in the leaflet issued this year, allows a lower standard of insulation than formerly, but Mr. Fennell evidently objects to this.

I will not occupy your space by quoting further instances, but can say that every grievance I have heard, when properly thrashed out, has proved to be that one or two regulations cut across some pet theory of the critic, and in consequence he condemns the regulations root and branch.

Let me repeat what I have said many times before: If anyone who takes exception to the 1924 Edition will send his carefully considered criticisms together with his carefully considered suggestions to the Institution, I know, as a member of the Wiring Rules Committee, that they will receive the same careful consideration.

Fredk. W. Purse,
Engineer and Manager.

Electricity Dept., West Ham, *November 6th*, 1925.

Under the above heading your correspondent, Mr. E. O. Walker, asks: "Is not the whole industry suffering from rules and regulations?" I should say emphatically, No! The rules drawn up by the I.E.E. are (in my opinion) very necessary, and the industry is suffering by these rules not being carried into effect. The fact that Mr. Walker has installed thousands of ordinary switches in places with stone floors does not prove that the rules are in error, even although Mr. Walker has not heard of any accident brought about by the use of such switches.

A great deal in your correspondent's letter is sound reasoning, but his first question and his later comment about electricity being hedged with regulations are (to my mind) unfair to a competent body like the I.E.E.

Although I am not a member of the I.E.E., I shall always give support to the rules where possible, and it is to be hoped that some day they will be carried fully into effect. Does Mr. Walker think that if there were no rules and regulations our industry would cease to suffer? I think not.

Polyphase.

November 2nd, 1925.

I am sorry that I have again to intervene in this correspondence, but the implication in Mr. Fennell's letter in your issue of November 6th that I have not written the truth compels a reply. It is indeed a novelty to me to have statements of fact which are within my knowledge referred to in such terms, but as presumably a simple and flat contradiction would not suffice in correspondence of this character, I must content myself with a more lengthy communication.

It will be necessary again to call attention to my original complaint against Mr. Fennell, which was a statement reflecting on Post Office engineers contained in the words "their talk of efficiency limits is a device to save themselves trouble." The point at issue is a simple one—are Post Office engineers lazy? Mr. Fennell has said, in effect, that Post Office engineers are so lazy that, to avoid having to place certain overhead lines underground, they invent an excuse which has no technical warrant. In reply to this charge of laziness I instanced the

fact that in the case of a power line projected by Mr. Fennell, the Post Office has offered to place its lines underground at 23 out of 29 crossings! Does this indicate laziness?

Speech efficiency of a circuit is not a myth, and, moreover, it cannot be arrived at in the manner adopted by Mr. Fennell, that is, by comparing the size of the overhead telephone wire with a 35,000-volt power line crossing a roadway. I sincerely hope that Mr. Fennell does not adopt similar reasoning as the technical basis for carrying out his distribution schemes.

The ease with which Mr. Fennell assumes that he knows all about other people's business is illustrated by his reference to his "Winsford calls," as though the function of the circuit was confined to operations between Northwich and that town. The circuit in question is one of a chain of links which may be required at any moment to make up circuits to any part of the United Kingdom, and to do this each link must have a minimum speech efficiency which is laid down, and which cannot be reduced without the possibility of long-distance calls being made difficult and unreliable. Because of the possibilities of being employed for such calls, say to John-o'-Groat's or Cork, "Z" junction circuits have an importance which cannot be appreciated by the narrow outlook envisaged by Mr. Fennell; all such circuits have their speech efficiency figures and there are no grounds for Mr. Fennell's "suspicion" "that there are no figures." I might well stop here but for the following in Mr. Fennell's letter:—

> "The order was made, I suggest, on the ground that the line is too paltry to put underground in the country on the score of cost, and that as we are prepared to pay, it is merely inertia and indifference which stands in our way. I suggest that Mr. Bartholomew makes too much of the generosity of the Post Office in putting subscribers' lines underground *at our cost*. It is their well-known policy to get them underground even at their own cost as soon as they can. I expect they would be glad if we asked and paid for them all to be put underground forthwith!"

Was there ever such a farrago put forward by an engineer in a technical paper? First the Post Office will not put lines underground because of inertia and indifference, even though the power company offers to pay the cost; next it is the Post Office's well-known policy to put lines underground, even at their own cost; and, finally, Mr. Fennell expects we should be glad if we were asked and paid for them all to be put underground! This, after saying that the placing of Post Office lines underground is refused because of the "trouble" involved in carrying out such work, to say nothing of "inertia and indifference" which stand in the way. I am afraid that Mr. Fennell will make a very illogical St. George! Perhaps, after all, he is more like a Don Quixote.

Mr. Borlase Matthews, in his letter in your issue of October 23rd, said: "Difficulties are made to be overcome, so I trust others of your readers will help in the solution of the problem how best to reduce the cost of overhead construction in this country. It is no use slanging the Electricity Commissioners or telephone engineers, but rather, as Mr. Fennell has done, draw attention to definite points that require modification or suggest how they can be countered, there being more ways of killing a cat than by hanging it." If the words "but rather" be placed after "as Mr. Fennell has done" instead of before, then I think this advice is very sound.

S. C. Bartholomew.

G.P.O., London, *November 9th*, 1925.

P.S.—As regards the photograph showing the North Wales Power Company's 135-kV line, I am afraid the "innocent and hitherto smiling country side" would not be much relieved even if the cradle were removed at the road crossing.

Motor Converters versus Rotary Converters.

As a designer of both motor converters and rotary converters, I am particularly interested in Mr. Wuthrich's letter in your last issue. Although, in my opinion, the rotary converter is on the whole slightly superior to the motor converter, I do not think Mr. Wuthrich has been quite fair to the latter.

One great advantage of the motor converter is its superior stability on fluctuating loads, but Mr. Wuthrich does not mention this important fact. Operating engineers with experience in this class of plant have decided opinions on this point.

May I further comment on the seven claims which Mr. Wuthrich discusses?

1. *Possibility of connecting the plant direct to the h.p. supply without transformer up to* 11,000 *volts.*—The rotary converter certainly has the advantage stated, but, on the other hand, many engineers object to the presence of the large quantity of transformer oil in the station with its risk of leakage and fire. The fact that the transformer acts as a choking coil would appear to be offset by the fact that the motor acts in the same way.

2. *Simple starting and nearly immediate synchronising.*—The rotary converter is usually more simple in this respect than the motor converter, especially with the method of self-synchronising in which separate chokers are used.

3. *High efficiency and possibility of maintaining a power factor always in the neighbourhood of unity.*—The full-load efficiency of the rotary converter is certainly higher than that of the motor converter, but the difference given by Mr. Wuthrich hardly represents modern practice. The full-load efficiency of a 1,000-kW motor converter with two bearings is not more than 1 per cent. less than that of a rotary converter and transformer. Further, on three-quarter load the difference is less and the efficiencies are approximately equal, while on half load the motor converter may have a slight advantage. Since machines usually work at about three-quarter load in service, it will be seen that the difference in practical efficiency is quite small. For the same range of voltage, the power factor of the motor converter is slightly higher than that of the rotary, owing to the higher reactance.

4. *Large range of regulation on the d.c. side.*—I cannot follow Mr. Wuthrich's explanation of why the motor converter has a greater range than the rotary, but it is a fact that the range is greater, for the same range of power factors, on account of the higher reactance of the motor. The rotary, however, has a great advantage when two ranges of d.c. voltage are required for lighting and traction. In this case, tappings may be provided on the transformer, one set for lighting and one for traction, so that unity power factor may be obtained at the mean voltage of either range. This can also be accomplished in the case of the motor converter by providing tappings on the stator winding, but it is by no means such a practical proposition as providing tappings on the transformer. Without tappings, the motor converter gives unity power factor at the mean voltage of the total range. It does not seem fair in this comparison to introduce the induction regulator, since it must be remembered that, although its use extends the permissible voltage range, it also introduces considerable complications by adding a piece of apparatus which requires artificial cooling and additional regulating gear.

5. *Perfect balancing in the case of three-wire systems.*—The rotary has a slight advantage, in that the out-of-balance current has to be carried through brushes and slip-rings in the case of the motor converter.

6. *Small peripheral speed.*—Large modern motor converters operate at the same peripheral speeds as rotaries.

7. *Safe operation without highly trained staff.*—I agree that the operation of a rotary is as simple as that of a motor converter, and the design of the two types can be made equally simple. The weak point mentioned by Mr. Wuthrich is eliminated by building motor converters with two bearings only, so that the leads do not have to pass through a hollow shaft. Motor converters up to 2,500 kW have been constructed in this way quite satisfactorily. This method has the further advantage of reducing the overall length of the set. The fact that the position of the transformer can be chosen independently is not such an advantage as would appear at first sight, in that the transformer must be placed as close as possible to the rotary, in order to save in the length of the heavy-current leads.

As I stated before, it is my opinion that, generally speaking, the rotary holds a slight advantage, but many engineers may hold the contrary opinion. Apart from general opinions, it is only by attaching appropriate weights to the various claims in each specific case that a correct decision can be made. Each case must be judged on its merits.

The price of the motor converter is not disproportionate, being practically identical with that of the rotary and transformer, so that it is quite reasonable that engineers who have had satisfactory service in the past with motor converters should hesitate to install a different type of machine to obtain a doubtful advantage.

There seems to be no question of "encouraging the present fad" for motor converters, since manufacturers who have built satisfactory 50-cycle rotaries for many years are now building both types of machine.

Robert G. Jakeman.

Birmingham, *November 3rd*, 1925.

The two communications which appear in your issue of November 6th entirely vindicate my contention that practically in every respect rotary converters are far superior to motor converters. Although Mr. Sieveking states that he is in favour of motor converters, he has made a clear case for rotary converters, and it is only necessary to make the following comments regarding his remarks:—

1. As a transformer is indispensable even with motor converters in installations with a higher supply pressure than 11,000 volts, surely rotary converters are a far cheaper proposition.

2. Mr. Sieveking appears to have been unfortunate with the rotary converters he has had to deal with. With properly designed gear the starting-up of rotary converters should be as easy as in the case of motor converters.

3. In modern sub-stations where a number of units are installed it is usual to arrange that the rotary converters in service work at full load and consequently with best efficiency.

4. It is quite erroneous to think that an induction regulator for a large machine is too big and too costly. If the induction regulator is merely required to secure for the rotary converter the same voltage regulation as a motor converter, the internal capacity of the regulator is very small. The cost of an induction regulator for use in conjunction with a 500-kW rotary-converter equipment for a 6,000-volt, 50-cycle supply, giving a pressure range of 380/460 volts on the d.c. side, would not exceed £200.

6. The only question that matters here is whether the necessary factor of safety can be obtained at the given peripheral speed, and whether the commutation is satisfactory. These conditions are, I contend, entirely fulfilled with modern rotary converters. The fact that 50-cycle traction rotary converters for 1,500 volts, 1,500 r.p.m., are not built in this country is no argument, as such equipment works on the Continent with perfect commutation and remarkable absence of the "ploughed field" appearance of commutator alluded to by Mr. Sieveking.

7. The contention that if an induction regulator is inserted into the rotary-converter circuit, the motor converter is easier to handle, is a perfect fallacy. An induction regulator can be operated by handwheel or remote controlled by servo-motor and push button from the switchboard; it can also be arranged to deal with the whole pressure regulation of the rotary converter with as much ease as a shunt regulator.

As regards Mr. Bunting's remarks, I agree that the efficiency figures I gave may not apply to the very latest design of motor converter or rotary converter, but as both types of plant are being continually improved in this respect, the difference in favour of the rotary converter still remains, though perhaps not quite so pronounced.

Regarding the question of design, the use of two bearings in the case of motor converters removes, it is true, the necessity of leading the rotor connections through the shaft. This means, however, that either the two armatures are connected together by means of a rigid coupling, which is an undesirable feature in my opinion, or that the shaft is in one piece, an arrangement which renders repairs on the two armatures more difficult, while the fact that leads have to be run along the shaft is not wholly satisfactory.

It would appear to me that the writers of the letters I have referred to have been guided too much by their own personal experience with particular designs of rotary converters, and though they may have been fortunate in handling very up-to-date motor converters, they have overlooked the fact that considerable strides have also been made in the construction of rotary converters. That a manufacturer who can build satisfactory 50-cycle rotary converters should choose to devote also his attention to the construction of motor converters, appears to me merely to demonstrate that he chooses the path of least resistance in a conservative market, overlooking, perhaps, the fact that he is thereby unnecessarily crowding his pattern shops.

G. Wüthrich.

London, *November 7th*, 1925.

Two-way Pendant Switch Flexibles.

In your issue of October 30th, page 717, are some remarks on the part of one of your correspondents on the use of one- and two-way flexibles, for pendant switch wiring.

He states that "there is no 2-way ratchet action ceiling switch on the market." He undoubtedly is in error, because we manufacture ceiling switches, including 2-way actions. We have pleasure in handing you a leaflet out of our accessories catalogue, illustrating and dealing with these ceiling switches. This is a line which has a large sale in countries abroad, but has only a relatively small sale in this country.

The General Accessories Co., Ltd.

London, *November 4th*, 1925.

The Cost of House Wiring.

The cutting of prices for house wiring, which has been the subject of correspondence in your columns, is one which all contractors feel at times. If the wireman is working for himself he naturally can afford to cut his "profits," as his labour alone will provide him with his week's wages.

It, however, is very noticeable that, in such cases, the wiring is done in very quick time—much quicker than when the wireman is working for a contractor.

It would be very interesting if your readers would let you know what the average hours per point for a wireman and mate work out at on an average installation of, say, from ten to fifteen lights, including the fixing of all switches, plain pendants, lamps, shades, main switch and distribution board, twin lead-covered wiring.

If you would then publish a summary of the replies it would be very helpful.

In our case the average is 4½ to 5 hours per point complete for a man and his mate.

Inquirer.

November 5th, 1925.

The Metering of Three-phase Power.

The article entitled "The Metering of Three-Phase Power" by Mr. George D. Malcolm which appeared in the issue of your valuable paper for October 30th, greatly interested me and will, no doubt, be of considerable interest to a large number of supply engineers in this country.

I have, for a great number of years, given this subject special consideration and, being in touch with most of the supply authorities in this country, I have had a unique opportunity of seeing the various forms of metering employed by them. Many undertakings keep a special staff for dealing with this important part of a supply undertaking, but I have often seen not only inadequate, but frequently inaccurate, systems of metering employed. Many, I regret to say, prove unfair to the consumer.

There is no doubt in my mind that the metering of electricity supply is a subject which should receive greater attention by the Government authorities or Electricity Commissioners.

Turning to the article appearing in your columns—I was disappointed that the author confined himself to so small a part of this subject. There are really many more important points to be considered in the metering of three-phase power, and I feel sure that further investigation on this subject would interest many of your readers.

May I suggest that the problem of the correct meter for a three-phase four-wire supply be a further development to this excellent article.

This is a subject on which a great difference of opinion seems to exist. I have, for a great many years, advocated the type of meter which employs three separate elements *and* rotors as being the only true meter for such a supply. The more usual method of splitting the three current windings between two elements (or where current transformers are used, they are connected in delta and the third phase is thus superimposed on the other two) is not one which will meet all the conditions which can occur on a three-phase four-wire supply. Large errors may occur with this meter. I have in mind one case where as much as 15 per cent. was found and this against the supply authority.

There are many other important points on this subject of three-phase metering, but space forbids entering into them here. I hope to complete a manual on "Correct Metering" one day, but unfortunately lack of time has made progress slow.

May I, in conclusion, suggest a slogan for the meter engineer: "Always install a meter which will register accurately under *all* of the conditions of load which *can* occur on the system to be metered."

H. Hugh Jaques.

London, *November 4th*, 1925.

Broadcasting Power.

I wish to express complete agreement with the remarks of Mr. H. P. Amphlett on the above subject. The matter seems rather beneath the serious notice of the technical Press, although some weeks ago I offered a protest to one of the Sunday papers against a similar article by Prof. Low. Rather than attempt to forecast the problematic miracles of a thousand years hence it is our immediate business to apply ourselves to improve the lot of the present generation, and to make such contribution to progress as lies in our power. Fiction is a thing apart. No doubt Mr. Stephen Leacock keeps his entertaining stories in a separate compartment from his University lectures—an example to be commended.

A fantastic flight of fancy coming from a member of a scientific profession and containing such emphatic phrases (from memory) as "both Sir Oliver Lodge and myself are agreed" is apt to carry conviction and to create a wrong impression among the general non-technical public.

E. W. Ashby.

Wallasey, *November 2nd*, 1925.

Is the Contracting Business Degenerating?

I was looking forward to reading in your last issue a word of commendation to "Hard-working Ex-service Electrical Contractor," but the only contribution to the discussion under the above heading was one from Mr. Barlow, which certainly was not intended to be cheerful reading for the gentleman who helped to win the war. The latter distinctly stated that he could carry out work on new buildings at 10s. 6d. per point, using all-British materials and within a radius of 20 miles of London—tested and fully guaranteed. This statement is clear enough, but in the letters which it evoked it is suggested that he is using Continental and other rubbish and that he will come to grief. This is not very complimentary to the gentleman who so recently was fighting for our existence. However, I do not suppose such innuendoes will worry him much: he has probably learned by now that the people who make them would not help him if he were down. Even if he were using material other than British, why should one describe it as rubbish? It is not necessarily rubbish because it is cheap: one might as well suggest that English cables were rubbish when they were being sold cheaper than they are to-day. I buy electric lamps cheaper from abroad than from the lamp-makers here because I prefer to have the difference between the price of them and the English in my pocket rather than in that of the English makers, and I have not found them rubbish. It is for the buyer to find out his best market, and in the case of our friend he is satisfied with the English for his materials, so what has one to cavil at? Surely he can sell his labour at whatever he likes to accept for it? Do not the majority of your advertisements read "State salary required"? In buying he possibly has an advantage over the buyers of some firms who could more correctly be described as "Order Clerks," as they are told where to place their orders by their employers, and if the employers are satisfied the buyers need not worry. But when one reads your "Correspondence" column one wonders whether they are wise in tying the hands of their buyers. When employing labour they have to pay the Union rate whether the man knows Ohm's law or has read "Chitty on Contracts," so that their only means of cutting costs is in material. "Ex-service man" buys British, but who could blame him if he bought foreign? By doing so he might miss the smile of the £1,000 (or more) a year politician who is advocating Communistic principles as far as they serve his purpose, but when down and out and the politician has retired on a pension will it matter? As one of your correspondents suggested that such people as "Ex-service man" figured among the unfortunate folk who appear in your weekly columns under bankruptcies, &c., I looked through these columns since his letter appeared and only found one wireman, 12 electrical engineers, 15 merchants, five manufacturers, and three agents. I do not know what class of business the electrical engineers carried on, but if we suppose they were

nothing more than wiremen, they were not so numerous as the merchants and agents. "Ex-service man" may reach Carey Street, but not at his present rate of progress. I see no reason why he should not develop a big business, and I have no doubt that as a practical man he will manage it just as well as his present. I can tell him for his encouragement that I had my house wired about 13 years ago at 10s. per point and that I have not yet had the slightest trouble over the work: the gentleman who did the work has now a very fine showroom in the principal street of the district and is doing a good business. I hope "Ex-service man" will succeed as well, but in the meantime he is bringing the light into many humble homes, making business for the supply companies and manufacturers, and laying the foundation of further business. He could no doubt do better abroad, but that is his business. In the meantime I think England retains a cheerful and an industrious worker.

Fairplay.

November 2nd, 1925.

Do Small Manufacturers Lack Ambition?

Talking to a business man the other day upon this subject, he said: "Small firms are such because they have little or no ambition or enterprise," but I am sure he was wrong.

In the majority of cases the reason is, I think, because they are manufacturers only, and do not fully appreciate the importance of salesmanship. It is one thing to make goods and another to sell them, and a manufacturer is rarely a salesman.

An American writer has it—

> "He who whispers down a well
> About the goods he has to sell,
> Will never reap the pounds and dollars
> Like he who climbs a tree and 'hollers.'"

Every factory needs three sorts of ability to make it successful—the financier, the manufacturer, and the salesman—three entirely different aptitudes. The financier has to be the "Shylock"—to think of profit—to watch the money coming in and that going out. He need know little or nothing about the manufacturing or the sales sides of the business. The manufacturer has to look after the actual production of the goods from the raw material to the finished article. He must know how to control labour; he must be a good buyer, but need not concern himself about the finance or the sales. The salesman must know the buyers—must know how to make people desire the goods—must be able to create demand. He need not greatly concern himself about either of the other two men.

The war taught the manufacturers of this country what could be done by specialisation in the making of a small variety of articles on mass production lines. No manufacturer had to concern himself about sales, for the Government, either directly or indirectly, bought all his goods. He could devote all his time and energies to devising new methods of production and to getting the greatest output.

At the present time the larger and more wealthy firms have established selling organisations with ramifications extending all over the world, and the smaller firms find themselves severely handicapped in competition with them, for just as the specialisation in the production of goods helps to cut manufacturing costs by reducing "overheads," so specialisation in the selling of the goods helps to cut selling costs, and the lower these costs are, the greater amount of publicity which can be put out. This additional publicity brings more sales, increases production still more, and thus helps to cut manufacturing costs still lower, and so on.

I think, therefore, that it is owing to the smaller firms being unable to afford such sales organisation that they are unable to reap the advantages which publicity brings, and hence must remain small or succumb to their more wealthy competitors.

Bromley. **A. M. W.**

[It is not clear what our correspondent means by "small firms." There are many of the smaller electrical companies whose selling organisations operate with greater efficiency than do those of some "larger and more wealthy" concerns. They show no lack of ambition and enterprise. At various times there have been grouped schemes for co-operative salesmanship enabling associated firms to compete more successfully in export markets. But much depends upon what the "small firm" has to sell—whether it is a speciality or is only a standard product in which it comes up against the competition of large-scale production.—EDS. ELEC. REV.]

Firemen's Risks.

In reference to your excellent notice of the recent inquest held before me under the provisions of the local City of London Fire Inquests Act, 1888, concerning (*a*) Sub Fire Officer Sinden, deceased, and (*b*) the fire at Byron House, Finsbury Street, City, E.C., at the fire inquest and in my statutory report, I particularly called attention to my fire card and poster published by the City Corporation for distribution throughout the City, namely (see enclosed):—

In all cases of fire in buildings, cut off the gas at the meter without a moment's loss of time.

It is also important when a fire occurs to cut off the electric current at the meter.

The Fire Brigade, apparently, prefer to take the risk of electrocution rather than be deprived of the use of the electric lighting at a fire. In enclosed cutting, if correct, the Fire Brigade say:—"The risk of electrocution is inseparable from the duties of a fireman."

In my summing-up and statutory report, I put the compulsory adoption of the new regulations of the Institution of Electrical Engineers, *re* electrical wiring, second to the radical cutting-off at once of the electric current.

F. J. Waldo.

Coroner's Office,
London, *November 2nd*, 1925.

P.S.—So far as I have seen, the posters only appear in the streets and a few public buildings, *e.g.*, police stations. I think they ought to be displayed in all factories, workshops, and warehouses in preference to the fire cards.—F. J. W.

[The quotation is from a report of the Fire Brigade Committee of the L.C.C., mentioned in the *Daily Graphic* of November 2nd.

Dr. Waldo's admirable poster giving instructions for use in the event of fire, and hints for the prevention of fire, to which we have previously drawn attention, is issued by the authority of the Court of Common Council, Guildhall, E.C., and ought to be exhibited in every factory, workshop, and warehouse.—EDS. ELEC. REV.]

Legal.

Brown, Douglas & Co. v. Enfield Ediswan Cable Works, Ltd.

The hearing of this case (see our last issue, p. 759) was continued by Mr. Justice Finlay, on November 2nd.

Mr. JOHN CAMERON RENNIE, electrical engineer, said that 600-megohm cable in a contract of the kind involved was intended to be used for pressures up to 250 V. He had examined some coils of the cable and saw no sign of their having been heated by being stored too close to boilers.

Cross-examined by Mr. Barrington Ward, witness said the Cable Makers' Association rules provided that the tests should be carried out at the makers' works. He would expect the cable to be tested at the works, but would not be surprised if tests were made elsewhere because he knew it was done.

In further answers to Mr. Ward, witness said he should not expect two journeys through the tropics to have a great effect on the condition of the cable. If subjected to excessive heat the cable would be adversely affected. In reply to Mr. Wingate Saul, witness said the insulation test was an important factor. Four failures out of fifteen tests of the "Non Association" cable was a high proportion of failures.

Mr. WILLIAM H. BALLANTYNE, B.Sc., recalled, said that if the cable had been put into a place of high temperature near the boilers on board ship as suggested, he would have seen signs on the wrapping.

Mr. ALFRED T. MORRIS, superintendent of the Faraday House test laboratory, gave evidence of the tests applied to the cable. Of the "Non Association" cable which he tested, four coils were below the figure of 2,000 megohms per mile, which was the standard necessary. He thought the defects were generally due to poor rubber. Of twelve coils of "Association" cable examined, six were below the standard of 2,000 megohms per mile.

Mr. BARRINGTON WARD, for the defence, said that he submitted that as to the "Non Association" cable the plaintiffs had no claim in law. Under the Sale of Goods Act, the plaintiffs having resold and passed the cable on, had no right to reject.

Mr. WINGATE SAUL said he did not dispute that.

Mr. WARD said that would affect the "Non Association" cable, and make a considerable difference in the damage, supposing his Lordship was against him in other respects. In his submission, as to the "Non Association" cable, the position was that when the users in New Zealand, who had been in the habit of using only "Association" cable, saw that it was not "Association," they would not use it, and hence the complaints. They, therefore, made a perfunctory test, and returned it. Defendants had made thousands of miles of cable for the Admiralty, War Office, and public bodies, and it was almost inconceivable that they could have turned out such a quantity of cable which would fail. It was part of a lot of 290 miles made, and no complaint had been received from anyone else. His case was that the cable, both "Association" and "Non Association," was correct when supplied.

Mr. LL. B. ATKINSON, director of the Cable Makers' Association, said that under the Association's rules all tests had to be made before the cable left the works. They had a mutual understanding not to guarantee cable after it left the works. Bad handling would greatly depreciate cable.

Mr. A. V. DOWNTON, technical director of the defendants' Enfield works, said that the present name of the defendant company was Enfield Cable Works, Ltd. The company sent a large amount of cable to New Zealand and other countries. It had a separate testing staff, and no cable was allowed to leave the works without being tested. They had no complaints from any other customer of any "Association" cable supplied during the last three months of 1920 and the first three months of 1921. "Association" cable was known in the trade and outside the trade to have a higher percentage of rubber than "Non-Association" cable. Witness further said that when some of the cases were opened this year, he found that the coils had been improperly packed for the return journey from New Zealand.

Mr. Frank Richards, chief electrician at defendants' Enfield works, said that no cable was allowed to go from the factory into stock without a test. Tests of the cable in dispute showed that the insulation resistance was over 2,000 megohms.

Mr. G. Dania, mechanical and electrical engineer, said that he had close upon forty years' experience of testing cable. He saw the cable said to have been returned from New Zealand. He picked up coils and found the rubber was good on some of them, while on other coils the rubber was harsh and short. Knowing that a manufacturer could not manufacture two classes of rubber at one and the same time, he was convinced that something had gone wrong and that there had been overheating somewhere, and the most likely place to have heating would be close up against the engine room or the boilers on board ship. The cable was not well packed. Rough handling and bad packing would destroy cable of the class in question, and would break down the insulation. He took three coils of the "Non Association" and of the "Association" cable and tested them. The insulation of the "Non Association" came out well, all three coils being over 2,000 megohms, and of the "Association" coils two were under and one over. In the coils under the standard the rubber was harsh and short. The cause would not be bad manufacture.

The hearing was adjourned and resumed on November 4th, when Mr. Wingate Saul applied to the Judge for leave to amend the pleadings in the plaintiffs' case. He admitted now the contention that there was no right to reject the whole consignment in New Zealand, and desired to base the claim instead on the ground of damages. He said the plaintiffs would be entitled to damages for the difference in the price of the cable as good and merchantable and its price in a defective state. In the latter condition it could be sold as bell wire.

Mr. Barrington Ward objected on the ground that it would be an injustice to the defendants in that the amendment was only asked for when the case was over, and they had had no opportunity to give evidence as to the value of bell wire, &c., in New Zealand.

His Lordship said that in view of the opinion he had formed, he thought it would be better to allow the amendment.

After counsel's final arguments, his Lordship gave judgment. He said that the first contract, made in July, 1920, was for the sale of fifty miles of "non-Association" 600-megohm cable, and the second contract, made in December and January, 1920-21, was for ten miles of 600-megohm "Association" cable. It was common ground between the parties that the defendants, who were people of the highest reputation in the trade and had a very extensive business in the sale and manufacture of cable, knew that both consignments were for shipment to New Zealand, and further, that they would be wanted for wiring houses or buildings for the purpose of electric lighting. Both the fifty and ten miles of cable were duly shipped and duly got to New Zealand, and there plaintiffs' correspondent rejected them, and the question with regard to the ten miles was whether they were justified in rejecting that cable. The question with regard to the fifty miles of cable was not whether they were justified in rejecting, because Mr. Wingate Saul conceded that, when it appeared that some fourteen miles out of the fifty had been sold, he could not maintain the claim that he was entitled to reject. The question with regard to the fifty miles was, it being conceded there was no right to reject, whether there was any damage, and what it should be, by reason of the fact that the cable did not come up to the standard required by the contract. When that cable got to New Zealand, one coil was tested, and that coil failed to answer the insulation test. It was common ground between the parties that the 600-megohm grade meant that there was a minimum insulation resistance of 2,000 megohms per mile. There was no doubt that the defendants undertook to supply cable which would stand that test. The question was whether it was made out, with regard to the fifty miles of cable, that, when it reached New Zealand, it failed to meet the test. He was unable to attach weight to the test which took place there. It was a test of only one coil, and was thus not a sufficient test. One coil having been tested, the rest of the fifty miles was kept in store for a rather long period. But, before the test, about fourteen miles had been sold, and there had been no complaint. He was satisfied no sufficient test was made as to the fifty miles in New Zealand. That being so, the rejection and the return were not justified. But, no doubt, the plaintiffs were entitled to say that, granted the tests there were insufficient, none the less they were entitled to go into the matter to show that, if they had tested thoroughly, the tests would have revealed the fact that the insulation resistance did not come up to the contract. Accepting that, one must look at what happened when the balance of the fifty miles got to England. The plaintiffs had got to satisfy him that by reason of what then took place that the "non-Association" cable was, when it got to New Zealand, unable to stand the test. The way they proposed to do that was to put in a report by Faraday House of a test made of a number of coils, fifteen in all. He noticed that two coils were of a very low insulation resistance indeed. With regard to one of those two coils, it was practically conceded that that must be due to some defect, a pin-hole, and that in coils such defects might occasionally arise. With regard to the other coil, on the evidence he arrived at the same conclusion that there was some mechanical defect of some sort. There were only two other coils which were below 2,000 megohms, and they were slightly below, so slightly that the view of Faraday House was at the time that the coils were satisfactory. In addition to that, he had got the fact that in 1922 a further test was made by Mr. Dania, who took three coils of the "non-Association" cable, and all the three coils answered the test. On those materials he (his Lordship) could not possibly say that it was made out to his satisfaction that when the plaintiffs, or their correspondent, rejected the cable, the cable was in such a state that rejection was justified. He could not hold that that "non-Association" cable—more especially having regard to the fact that, in addition to the two voyages, it had lain for a long period, fourteen months, in a warehouse—was in such a state when it reached New Zealand as to fail to answer to the test. He must, therefore, hold that, with regard to the "non-Association" cable, the plaintiffs' case failed. He had now to deal with a different and more difficult part of the case, that which related to the "Association" cable. It was shipped in March, 1921, and it returned in March, 1922. It was, therefore, away for about a year, and, of course, the two voyages had to be taken out of that. With regard to the tests in New Zealand, which were much more satisfactory than the tests of the "non-Association" cable because two coils were tested, he thought it might well have been wise if, when the two coils failed to answer the test, some more had been tested. When the cable returned to this country it was subjected to a test at Faraday House, and that test substantially showed that half of the coils failed to answer the test. There was further the circumstance that Mr. Dania subjected three coils to a test in April, 1922, about a month after the cable had got back, and one coil showed an insulation resistance of 3,860 megohms, and the two other coils fell much below 2,000 megohms. He saw no reason why he should not accept the Faraday House test as being substantially accurate. He saw no more reason why he should refuse to accept the rather striking figures which Mr. Dania gave him as to the three coils which he tested. He had come to the conclusion that the ten miles of cable failed to answer the contract terms, and plaintiffs must have judgment in respect of it. There would be judgment for the plaintiffs for £164, but, having regard to the fact that plaintiffs had failed with regard to the fifty miles of cable, in the exercise of his discretion judgment would be without costs.

Metropolitan-Vickers Electrical Co., Ltd., v. British Thomson-Houston Co., Ltd.

The opening of this appeal of the plaintiffs against a judgment of Mr. Justice Lawrence, holding that the defendants had not infringed a patent owned by the plaintiffs relating to rotary converters, was reported in our last issue (p. 759). On November 4th, Sir Duncan Kerly, continuing his address on behalf of the appellants, dealing with the alleged anticipation of Tesla's publication, said that the synchronous motor which Tesla was working on would not start itself. He arranged his motor with a series of projections, each of which was wound with wire. He could not get the operation of magnetising and de-magnetising, and so get the thing off. What was a large synchronous motor in Tesla's day was probably a 1-h.p. one. Tesla had only done a part of what Rosenberg had done. A limit must be put on an alleged paper anticipation. They were not to assume that a paper anticipation of an early date had taught the world anything which it did not describe, and fairly describe. He contended that when the problem to be solved was appreciated, one did not find in Tesla the arrangement as described by Rosenberg.

The hearing was adjourned, and upon the resumption on November 5th, Mr. Whitehead, K.C., followed Sir Duncan Kerly, K.C., on behalf of the appellants, and at the close of their case, Sir Arthur Colefax, K.C., supported the judgment of Mr. Justice Lawrence on the issue as to the validity of Rosenberg's patent on behalf of the respondents. He said that the question of validity was in reality a matter of construction and what appeared in Tesla's prior publication. Mr. Justice Lawrence had only dealt with Claim 1 of Rosenberg's specification, and therefore he thought there was only one claim to be considered by that Court. The respondents denied that the alleged invention of Rosenberg was one of outstanding merit as had been suggested.

Brown Bros., Ltd., v. Bell & Pugh.

In the Chancery Division on November 4th, Mr. Justice Romer heard an application by Brown Brothers, Ltd., Great Eastern Street, E.C., for an injunction restraining Thomas William Bell and Alfred Pugh, of Liverpool, from carrying on business as makers or dealers in radio apparatus under the name "Brown Brothers."

Mr. Farwell, K.C., said that the plaintiffs started wireless business in 1922 and their name had acquired a reputation. Last November the defendants began to trade at Liverpool as "Brown Brothers," and had a stall at a Liverpool radio exhibition in that name. Confusion had arisen owing to the similarity of the names, and the plaintiffs were likely to suffer harm from it.

For the defendants, Mr. Stone said their trade was solely in the Liverpool district and they submitted that the plaintiffs' reputation applied only to their motor and cycle business. The defendants took the name because Mr. Pugh was for some years a traveller for a firm of Brown & Co. and he was known in the Liverpool district as Mr. Brown. There was no evidence that they had interfered with the plaintiffs' business.

His Lordship held that the defendants, in taking the name had not acted honestly, but with a desire to obtain some of the plaintiffs' business. He found that in the radio trade the words "Brown Bros." meant the plaintiffs' goods and the use

of them by others would cause confusion. He granted the injunction.

Mr. FARWELL later said it had been agreed to treat the motion as the trial of the action, there would be a perpetual injunction in the terms of the notice of motion, with costs, and the plaintiffs would waive all questions of damage.

Marconi's Wireless Telegraph Co., Ltd., v. International Wireless Manufacturers, Ltd.

A PETITION by the first-named company for an order for the compulsory winding-up of International Wireless Manufacturers, Ltd., came before Mr. Justice Romer in the Companies' Winding-up Court on November 3rd, the petitioners being creditors for £230 for royalties on radio instruments.

Counsel for petitioners said the company was formed with a capital of £100, of which £80 was paid up, but it had issued debentures for £4,000, and the debenture holders had appointed a receiver and manager.

Counsel for the respondent company asked for an adjournment to allow evidence to be filed by creditors opposing the petition. The business, he said, was growing rapidly and if the company was wound up now there would not be enough to satisfy the debenture holders. They had had to take on extra hands to cope with orders.

His Lordship adjourned the petition for a month.

Mullings v. British Thomson-Houston Co., Ltd.

MR. THOMAS MULLINGS, of Merton, on November 3rd was awarded £1,150 damages for personal injuries against the British Thomson-Houston Company, Ltd., by Mr. Justice Horridge and a special jury.

Mr. Mullings, an advertisement manager, was walking along Seacoal Lane, Farringdon Street, E.C., on November 14th, 1924, while the servants of the defendant company were moving some plant into the sub-station of the Charing Cross City and West End Electricity Supply Company, and owing, as Mr. Mullings alleged, to the negligence of the defendants' servants, a large piece of timber was allowed to fall on his head, causing concussion, laceration of the brain, and shock.

London Electric Supply Corporation Summoned.

AT the Greenwich Police Court on November 9th, the London Electric Supply Corporation, Ltd., was summoned for neglecting to protect as far as possible all parts of an e.h.p. transformer at its Deptford station to guard against danger to employés. It was stated that a man in the company's employment (Mr. C. H. Harwood) was killed recently by coming into contact with a "live" part of the transformer, receiving a shock at 10,000 V. After hearing evidence the magistrates adjourned the summons.

Theft of Radio Apparatus.

AT Nottingham on November 7th, G. E. Morris, a clerk in the employment of the General Electric Co., Ltd., was sentenced to six months' imprisonment in the second division for stealing radio apparatus from his employers. F. S. Freeman, trading as the Super Radio Co., and C. Baker, a traveller, received similar sentences for receiving the goods.

Millet v. Kaplan.

IN the Mayor's and City of London Court, before Judge Shewell Cooper on November 6th. Mr. J. Millet, 22, Farringdon Avenue, wireless material merchant, sued Mr. H. Kaplan, trading as H. Arnold, 35, Euston Arcade, St. Pancras, for £37 8s. 6d. for goods supplied. The delivery of the goods was admitted, but the defendant contended that the goods were supplied to a company called the Standard Accessories Co., Ltd., of which he was the managing director, and not to him personally. Evidence was given by Mr. Millet and a traveller in his employment that they had had an interview with the defendant at the offices of the Standard Accessories Co., Ltd., in the course of which Mr. Millet asked Mr. Kaplan to be responsible for the goods which had been ordered. Although Mr. Kaplan refused to give a written guarantee, he said that he would guarantee payment. Mr. KAPLAN said that the goods were ordered on behalf of the Standard Accessories Co., Ltd., and he had refused to give a personal guarantee. He admitted that the Standard Accessories Co., Ltd., shortly afterwards went into voluntary liquidation.—Judge SHEWELL COOPER said that the defence was of the most flimsy description. He gave judgment for the plaintiff for the amount claimed, with costs.

Hydleman v. Goding.

IN the Mayor's and City of London Court on November 5th, before Mr. Registrar Dell, Mr. L. J. Hydleman, trading as L. J. Hydleman & Co., Queen Victoria Street, E.C., claimed £3 11s. 9d., the balance of the amount due for the supply of h.p. radio batteries to the defendant, Mr. R. R. Goding, trading as the National Wireless & Electrical Co., Gray's Inn Road, W.C. For the plaintiff it was stated that the bulk of the money due had been paid, and upon making the last payment the defendant apologised for the delay which, he said, was due to slackness of trade. Eventually, however, he refused to pay the balance now sued for and returned a number of batteries as defective. The plaintiffs refused to accept them, alleging that they had been maltreated. The defendant maintained that the batteries were defective and had not been improperly treated by him. Delay had occurred in returning them because he had waited until a number were proved defective.

The REGISTRAR said that such delay in returning goods alleged to be defective was always viewed with suspicion. The fact that defendant had paid part of the cost of the batteries without complaint led him to conclude that the defence failed. Judgment was given for the plaintiff for the amount claimed, with costs, and an order for payment within 14 days was made.

German-American "Bosch" Litigation.

MR. JUSTICE ASTBURY, in the Chancery Division, on November 4th, gave judgment in this case, which was reported in our issues of October 30th (p. 719) and November 6th (p. 758). His Lordship said that the Robert Bosch Aktiengesellschaft, of Stuttgart, was formed by Robert Bosch, who was the originator of the well-known Bosch magneto and other electrical apparatus. A name mark, unless represented in some special manner, could only be registered under the provisions of subsection 5, section 9, of the Trade Marks Act, 1905, and it was one of the most difficult classes of marks to be placed on the register. The real question which he had to decide was whether the word "Bosch" in the circumstances proved in evidence was distinctive of the products of the Stuttgart firm within the meaning of the statute. In order to succeed the applicants must prove that substantially all people in this country dealing in this class of goods at the date of the applications recognised Bosch as meaning and only meaning the goods of the Stuttgart firm. It was not disputed that up to the outbreak of the war "Bosch," applied to electrical apparatus, meant and was distinctive of the goods of the Stuttgart firm; but it was contended that from the date of the commencement of the war circumstances had entirely changed in this country and that Robert Bosch himself had recognised that change. He thought it was accurate to say that from 1914 to 1922 the date of the applications in this case, there were as many, if not a great deal more, American Bosch units in this country than there were Stuttgart units. In these circumstances it seemed to him hopeless to suppose that the people who handled the enormous bulk of the American Bosch property could have all or mostly supposed that it was property coming from the German firm marked as it was with American indications. Nor did he believe, having regard to the evidence, that anything like the whole of the people who dealt with these matters believed that they were made by the American branch of the Stuttgart firm. Even if they did they would still be the products of an independent Corporation in America in which the Stuttgart firm might, or might not, have been interested. From 1914 to the present date there had been as many Bosch units in this country coming from America as from Stuttgart. It was absolutely impossible to say that the surname Bosch meant Robert Bosch's goods, and his only. If this registration were allowed his Lordship could see no end to the litigation that might be caused to innocent people who had purchased and were using those American goods. His Lordship allowed the appeal and directed the applicants to pay the costs.

Reviews.

Oscillographs. By J. T. IRWIN, M.I.E.E. Pp. xii+164; figs. 81. London: Sir Isaac Pitman & Sons. Price 7s. 6d. net.

Till recently, the comparative paucity of English books dealing with electrical instruments was rather remarkable. During the last few years, however, a number of excellent works on this subject have been published, and the literature is now fairly complete. The work before us will undoubtedly fill one of the few gaps still remaining, and on general grounds a treatise on oscillographs is welcome. The fact that the author of the book is so distinguished an authority on this subject gives additional interest to its appearance, and we are not surprised that, in a relatively small space, Mr. Irwin has presented a thorough and readable account of the various types of oscillograph now available. The work is generally theoretical in treatment, and a sound knowledge of elementary mathematics is necessary for intelligent reading.

The opening chapter deals with the elementary theory of a vibrating wire carrying a current in a magnetic field; and the student will do well to master this thoroughly before proceeding to the main contents of the work. The various types of oscillograph are each considered fully, the theory being worked out in each case. The consideration of the cathode ray instrument is deferred till the end of the book, when the principles are briefly considered and the principal types described. The lengthy chapter on errors of indication and methods of damping is a most important one, and considers fully the numerical interpretation of oscillograph records. The author, using the vector method of representing the various forces acting on the vibrating wire, shows clearly the effect f

damping on the indications of amplitude and phase of the harmonics of the wave under consideration.

Working out a particular case, it is shown that at a frequency of 0.2 of that of the resonant frequency of the wire, the amplitude is 4 per cent. too high and the phase error is 0.57 deg. without damping, whilst with critical damping the amplitude error is 4 per cent. low, and the phase error is 22.5 deg. The author also points out that with oil damping the resonant frequency is reduced to a greater extent than that caused by damping alone owing to the increased effective mass of the wire due to movement of the oil. The theory of the author's resonant shunt is then dealt with and it is shown that, with this method, not only is the amount of damping adjustable and definite, but that for any given value, the magnification and phase displacement are such as would be given by a massless viscous damping fluid. This interesting chapter embodies a large amount of the author's original work on the subject.

It is somewhat ungracious to offer a word of criticism on so able a book as the one under review. We wish, however, that Mr. Irwin had given a little space to practical directions in the use of the oscillograph. This instrument is no longer confined to the research laboratory, but forms part of the testing equipment of even moderate sized electricity undertakings. A little space devoted to details of manipulation would, we feel sure, have been very acceptable to occasional users of the instrument. Otherwise, we can cordially recommend the book. It is well written and produced, the illustrations are of a high order, and a bibliography is appended, giving references to the most important papers, for the use of those wishing to pursue the subject.

Phases of Modern Science. Pp. viii + 232. London: A. & F. Denny, Ltd. Price 3s. 6d.

This is the second edition of a volume published in connection with the excellent science exhibit, arranged by a Committee of the Royal Society in the Pavilion of H.M. Government at the British Empire Exhibition; a large number of distinguished authors have contributed to its contents in the form of short articles, which have been revised; some of those which appeared in the former edition have been omitted, and others relating to the exhibits in their altered arrangement have been added. These articles occupy 158 pages, the rest of the book being a guide to the exhibits, many of which are demonstrated in operation.

We cannot speak too highly either of the exhibits or of this volume. The authors of the 23 articles are pre-eminent in their respective subjects, and have succeeded in compressing into small space a wonderful amount of up-to-date information, in a form suitable for the digestion not only of the scientific reader, but also of the inquiring layman. An interesting feature is the frontispiece—a reproduction of a large wall diagram forming one of the exhibits, which shows the whole range of electromagnetic waves, covering 62 octaves, from a wave-length of 0.01 Angstrom unit to one of 352,000,000 cm.—all of which waves travel with a uniform velocity of 30,000,000,000 cm. per second. The general use of radio telephony has gone far to familiarise the public with the idea of "waves," and to awaken an interest in science which will be further stimulated by the Science Exhibit and such works as the one under review.

Trade-mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 4th:—

Noris-Chromo. No. 456,446; Noris-Excello, No. 456,447; and Noris, No. 456,448. Class 4. Electric and galvanic carbons; and Noris-Tubus, No. 462,367. All goods in Class 4.—The firm trading as C. Conradty, 9, Spittlertorgrab, Nuremberg, Germany. (British representative: S. Sokal, 1, Great James Street, Bedford Row, W.C.1.)

Silex. No. 459,348. Class 6. Electric drills, hammers, grinders, and parts thereof.—B. E. N. Patents, Ltd., 100, Victoria Street, S.W.1.

Verniometer. No. 460,025 All goods in Class 8.—India Rubber, Gutta Percha & Telegraph Works Co., Ltd., 106, Cannon Street, E.C.4.

Dumetohm. No. 462,245. Class 8. Electrical resistances.—The Dubilier Condenser Co. (1925), Ltd., Victoria Road, North Acton, W.3.

Somnium. No. 462,650. Class 11. Electrical apparatus for use in light therapy.—John Bell & Croyden, Ltd., 50-52, Wigmore Street, W.1.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

2,417. "Starting apparatus for electric motors." R. W. Cousins. April 14th, 1924. (241,241.)

13,984. "Electric switches." R. W. Bill and H. Heath. June 10th, 1924. (241,247.)

14,270. "Apparatus for detecting and determining the position of stretches of underground of different electric conductivity." Piepmeyer & Co. Kommandit-Ges. and N. Gella. June 12th, 1924. (241,251.)

16,079. "High-temperature resistance furnaces." W. E. Prytherch. April 3rd, 1925. (241,256.)

16,442. "Low-frequency thermionic amplifiers." H. Green. July 9th, 1924. (241,257.)

16,629. "Electric means for indicating and/or recording the movements of bodies." G. Campos and B. Usigli. July 10th, 1924. (241,259.)

16,899. "Impulse transmitters for use in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd. May 15th, 1924. (234,036.)

17,060. "Diaphragms for acoustic instruments." H. J. Round. July 16th, 1924. (Cognate application 3,208/25.) (241,277.)

17,107. "Jointing compositions for use in jointing and connecting electric cables and conductors." G. H. Scholes, F. J. Pearce, and G. H. Scholes and Co., Ltd. July 17th, 1924. (241,280.)

17,154. "Electric switches." F. B. Dehn (E. G. Budd Manufacturing Co., Ltd.). July 17th, 1924. (241,284.)

17,192. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., J. E. Ostline, and W. O. Passmore. July 17th, 1924. (241,287.)

17,195. "Valve generators of electrical oscillations." C. S. Franklin and E. Green. July 17th, 1924. (241,289.)

17,347. "Coating of electrical conductors." A. D. Shuter. July 19th, 1924. (241,294.)

17,355. "Arrangements for increasing the frequency of electric currents." M. L. Touly. August 18th, 1923. (220,608.)

17,365. "Connections for three-phase current transformers." J. W. Kirkland (Allgemeine Elektricitats-Ges.). July 19th, 1924. (241,296.)

17,561. "Testing arrangements for selector with self-drive used in automatic or semi-automatic telephone systems." Siemens Bros. & Co., Ltd., and W. G. Patterson. July 22nd, 1924. (241,301.)

17,610. "Manufacture of coated metal filaments for use as electron-emitting cathodes." General Electric Co., Ltd., and C. J. Smithells. July 23rd, 1924. (241,304.)

17,885. "Electric switches, relays, and the like." Igranic Electric Co., Ltd., and J. H. Abbink-Spaink. July 26th, 1924. (241,310.)

18,024. "Contact plugs." Naamloose Vennootschap Philips Gloeilampenfabrieken. August 2nd, 1923. (Addition to 217,220.) (219,979.)

18,238. "Mechanical relays for electric switchgear and other purposes." British Thomson-Houston Co., Ltd., and H. C. Heath. July 30th, 1924. (241,316.)

18,555. "Electrical fuses or cut-outs." Midland Electric Manufacturing Co., Ltd., and W. L. Barber. August 5th, 1924. (241,322.)

18,779. "Telegraph signalling systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). August 7th, 1924. (241,327.)

20,389. "Devices for transmitting or reproducing sound." S. G. Brown. August 28th, 1924. (241,343.)

21,609. "Blow-out arrangements for electric switches." English Electric Co., Ltd., and F. D. H. Bremner. September 12th, 1924. (241,356.)

22,792. "Carrier-wave working over high-tension lines." Western Electric Co., Ltd. (Western Electric Co. Inc.). September 3rd, 1924. (Divided application on 222,104.) (Patent of addition not granted.) (241,368.)

22,893. "Tuning coils used in connection with wireless telegraphy and telephony." R. E. Barbour. September 29th, 1924. (241,371.)

23,355. "Vacuum discharge tubes or bulbs for illuminating or advertising purposes, and methods of mounting same." E. V. Hayes-Gratze. October 3rd, 1924. (241,375.)

23,481. "Electrical transformers." S. A. Stigant, A. E. Holliman, and Johnson & Phillips, Ltd. October 4th, 1924. (241,376.)

23,937. "Electric switches." British Thomson-Houston Co., Ltd., and L. Rigg-Story. October 9th, 1924. (241,378.)

24,070. "Supports for electric resistances." H. H. Berry. October 10th, 1924. (241,379.)

24,623. "Electric inductance coils." D. Macadie. October 16th, 1924. (241,383.)

25,059. "Starting devices for electric motors." British Thomson-Houston Co., Ltd., and G. O. Watson. October 21st, 1924. (241,390.)

25,131. "Direct-current dynamo-electric machine groups." English Electric Co., Ltd., and J. E. Calverley. October 22nd, 1924. (241,391.)

26,664. "Thermionic oscillation generators." Telefunken Ges für Drahtlose Telegraphie. December 19th, 1923. (226,505.)

26,812. "Electric ignition indicators." A. V La Due. November 10th, 1924. (241,397.)

27,537. "Means employed for repeating the condition of electric lamps." E. W. Timmis. November 18th, 1924. (241,406.)

28,803. "Methods and apparatus for sounding and for locating submarine obstacles by means of ultra-audible waves." P. Langevin and C. L. Florisson. December 27th, 1923. (226,795.)

30,380. "Electric signalling system." M. J. Huizinga. December 17th, 1924. (241,417.)

1925.

2,593. "Construction for mounting pole-pieces on the rotors of electrical machines." Maschinenfabrik Oerlikon. February 15th, 1924. (229,281.)

4,269. "Grid electrode for electron-discharge tubes." E. Schrack. February 16th, 1925. (241,439.)

4,402. "Magnetic chucks and the like." Magnet-Werk Ges. Eisenach Spezialfabrik für Elektro-Magnet-Apparate. September 27th, 1924. (240,405.)

5,605. "Collapsible carrier for electric accumulators and the like." T. F. Lowland. March 2nd, 1925. (241,443.)

7,812. "Electric-iron plugs." B. G. C. Stephens. March 23rd, 1925. (241,454.)

7,875. "Electric motor controllers." Singer Manufacturing Co. November 19th, 1924. (241,456.)

8,706. "Safety devices for electrical circuits." Calor Elektrizitats-Ges. and O. Dreyer. April 1st, 1925. (241,458.)

9,833. "Furnace electrodes." C. W. Becker. April 15th, 1925. (241,461.)

9,983. "Method of and means for switching out portions of circuits with wattless current commutators." Siemens-Schuckertwerke Ges. April 17th, 1924. (232,619.)

11,583. "Electric heaters for boiling water and generating steam." E. Shrubsole. May 4th, 1925. (241,473.)

11,800. "Switches for mine railways." G. Kunstler. May 6th, 1925. (241,476.)

11,819. "Electric steam generators." British Thomson-Houston Co., Ltd. May 16th, 1924. (234,087.)

13,433. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. May 24th, 1924. (234,510.)

13,434. "Electric protective arrangements." British Thomson-Houston Co., Ltd. (General Electric Co.). May 22nd, 1925. (241,484.)

15,089. "Manufacture of krarup conductors." E. Wollin. June 13th, 1924. (235,570.)

17,983. "Sound amplifying and reproducing device for talking machines and other sound-reproducing instruments." A. Midence. July 18th, 1924. (237,255.)

18,509. "Impulse transmitters for use in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd. May 15th, 1924. (Divided application on 234,036.) (237,290.)

21,495. "Electric incandescent devices." British Thomson-Houston Co., Ltd. August 30th, 1924. (239,221.)

The "Kennelly-Heaviside" Layer.—Writing to *Nature* of October 24th, Dr. Alexander Russell points out that "the hypothesis of an electrically conducting stratum in the upper air was clearly enunciated in an article by Prof. A. E. Kennelly, of Harvard University, published in the *Electrical World and Engineer* of New York on March 15th, 1902. The official date of Heaviside's disclosure of his hypothesis is December 19th, 1902. About the same date H. Poincaré, A. Blondel, and C. E. Guillaume made similar hypotheses. If names are to be attached to this hypothetical layer it should be called, in equity, the 'Kennelly-Heaviside' layer, a name which is beginning to be used in America."